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Scrapping War Vessels Means That New Passenger Ships Are Imperative

WE are in full accord with the principle of the limitation of armaments and the cessation of the mad race for naval supremacy in "capital ships" which in the end can only mean financial ruin for the nations involved. But as great sea battles were fought in the days of ancient Rome with wooden vessels propelled by oars so could terrible conflicts be waged today with the giant ocean liners hastily equipped with aerial, chemical and submarine instruments of warfare too numerous to mention.

America must not forget that the importance of England's and Japan's great fleets of ocean liners will increase in far greater than direct proportion to the number of warships scrapped. We must start at once to construct a fleet of our own passenger ships, not only because they are sorely needed for commercial reasons but because the fast ocean greyhounds of foreign countries will have become the "capital ships" before the ten year naval holiday is over.

These liners are no more vulnerable to submarines than the battleships built prior to our 1916 program which we propose to scrap. On the contrary, and on account of their great length, they are now so constructed that four adjacent holds must be flooded to sink them. They can be convoyed by destroyers and auxiliaries to meet such of these vessels as we retain and they can carry light fast æroplanes equipped with machine guns which are more than a match for the heavy and comparatively slow bombing planes that would be capable of destroying them. In other words, the crux of the science of warfare is the ability to take and hold a position, and when the naval ships are gone, the giant liners will be the only vessels capable of carrying sufficient forces and supplies to do this.

And as our merchant marine, equipped as privateers, sank 2,000 British merchant vessels in the war of 1812 so could these foreign liners capture every vessel that we sent out. Right now, for example, there are ten Japanese and British steamship companies competing against one American company for the trans-Pacific freight and passenger traffic of Puget Sound. What else than 10 to 1 would be the ratio of the foreign naval strength to ours in that part of the world, if the navy is scrapped?

Why did the British Government loan the Cunard company sufficient money to build the *Mauretania* and the *Lusitania* and then provide a subvention sufficient to pay the interest and amortize the loan? Was it not because these vessels could be used for naval purposes even with a large navy in existence? Then how much more important will this type of ship be when there are no modern battleships?

But outside of protection, we need fast mail and passenger steamers for all our principal seaports on both the Atlantic and Pacific coast. We need over a hundred of them to balance our fleet and if we had them on regular lines they would create business for the freighters that are now tied up. Everyone knows that freight rates are scraping bottom but passenger fares this summer were higher than ever. Why? Because there is a deficiency rather than a surplus of passenger ships.

The time has now arrived when Congress can no longer evade this question. Although the Jones Law provides for the indirect aid that is necessary for the successful operation of our ships, we have reason to believe that the President is about to ask Congress to substitute direct subsidies in place of discriminating duties. Let us take a small fraction of the money that we would spend on naval vessels and put our merchant marine on its feet. In no other way can the United States, holding as it does the unique position of having no axe to grind, and no territory that it desires to acquire, retain the power to exert a proper amount of influence to prevent future conflicts. We should not only replace

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the battleships that we scrap—ton for ton—with ocean liners but we should see to it that there are enough American ships suitable to carry the outgoing mail from all the principal sea ports of the United States.

Shipping Subventions

"IF we are to develop a successful merchant marine, we have got to pay for it one way or another." So spoke Mr. Holden A. Evans, then president of the Baltimore Dry Docks and Repair Company, at a banquet given by the National Marine League at the Hotel Commodore in the spring of the year 1919.

Mr. E. N. Hurley, who at that time was chairman of the Shipping Board, had just outlined his plan for the development of our shipping, and other speakers, influenced no doubt by America's remarkable achievements in manufacturing and other industries, had preached the "blue sky" doctrine that American ability and organization would assure the success of our merchant marine, when Mr. Evans, the only speaker in that optimistic gathering who had the foresight and courage to express his convictions, explained the shipping problems of this country in plain words which today are apparent and self-evident.

In some way or another the cost of operation and construction of American ships as compared with the corresponding prices paid by other nations must be compensated for or we can never become a maritime nation. It is unreasonable to expect that the labor that goes into the construction of a ship and its equipment which is subject to the high cost of living in this country will accept a foreign standard of wages. And this is equally true in operation, if we wish to man our vessels with American seamen.

Shipping and shipbuilding must rise or fall together, for successful operation requires the ability and knowledge to construct the most efficient, the most economical and the most modern type of ship and machinery for the particular trade or route upon which the vessel is to run. "There is not a surplus of useful ships," said President Franklin of the International Mercantile Marine Company last month. Our fleet is not balanced; if it were, we could place in commission a number of vessels that are now tied up. A proper subsidy is required for the operation of American vessels and this subvention would automatically place a premium on ships constructed in American yards.

It is all very well to talk about our ingenuity, mass production and the driving force of American organization, but a ship is not a typewriter or an automobile; it more nearly resembles a building in which the individual members must be erected and connected part by part. And, further, ask Joe Powell or Homer Ferguson if the majority of our best shipbuilding mechanics today did not learn their business in Great Britain?

Our shipping problem today has been complicated by the Conference on the Limitation of Armaments. It is understood that the President believes that the modification of treaties required for the enforcement of the discriminatory features of the Jones Act and the passage of the Borah Bill, exempting our coastwise ships from the payment of Panama Canal tools, would endanger the success of the Conference. As the President alone has the power to carry out the notification necessary for the modification of treaties we must now fight for a direct subsidy. We do not want a subsidy that will permit the operation of inefficient vessels. We want a subsidy only sufficient to induce capital to operate the best ships of our fleet and to construct the ships that are needed in American shipyards.

How much such a subvention would be, taking into account present costs, has not to our knowledge been determined. For a rough estimate between $30,000,000 and $50,000,000 per annum invested in subventions would save this country many times that amount in ocean freights.

Pioneer Purchasers

THE question of whether or not the original purchasers of Shipping Board vessels who paid $200 a ton for their ships shall be compelled to complete their payments and abide by their contracts involves a great deal more than a Santa Claus arrangement on the part of the Government to release them from a bad bargain.

Mr. R. H. M. Robinson, acting president of the United American Lines, stated very concisely at a recent hearing before the Shipping Board why it was to the interest of the Government to make such a readjustment in prices. He said in part:

"It should require little argument to show that any policy likely to result in the ruin of American companies who have already purchased ships from their Government (and that is what a strict enforcement of existing contracts will mean) would be almost totally destructive of the possibility of further investment of private capital in shipping.

"If the enthusiasm and initiative of the present private operators are crushed, if their attempt to assist the nation in disposing of its ships and in building up carrying trades for its commodities is rewarded only by ruinous losses, they will not be able to continue in business and another generation may pass before private capital can again be enticed to enter the shipping field and without private capital interested private ownership is impossible, and an American merchant marine becomes an abstract idea only."

In other words America has very few experienced ship operators and it cannot afford, in view of the fact that it demanded outrageous prices for its ships, based on an artificial situation, and then failed to afford the constructive help promised, to risk putting these men out of business when there are no others to take their places.

The plan of straightening out the difficulty which was also presented by Mr. Robinson would involve the fixing of a price for these ships approximating their present market value, a charter hire from the time of the purchase varying with the course of the market and the crediting of the sums paid in to the charter hire for the period of possession of the vessels and to payments on the revised purchase price.

The merit of this plan lies in the fact that adjustments could be made in negotiable certificates of credit which would be acceptable for further tonnage. As it is extremely doubtful if the Government can sell all of its 1,440 ships, it would appear that the Shipping Board has everything to gain and nothing to lose by recommending this plan to Congress.

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Our Chance to Secure the Blue Ribbon of the Atlantic

Battle Cruisers Can Be Converted into 25-Knot Passenger Liners —Would Carry 3,500 Passengers and 2,500 Tons of Cargo

THE offer made by the United States representatives at the "Limitation of Armament" conference to scrap the twelve great capital ships now under construction for the Navy Department has naturally excited the most lively and widespread interest in shipbuilding and ship operating circles. This is due partly to the effect of such action upon the future power of our Navy, partly to the effect, direct and indirect, upon the large number of industrial establishments concerned and partly to disappointment that the solution of the many important engineering problems involved must be, at least temporarily and perhaps indefinitely, postponed.

The six battle cruisers, although not as far advanced as the battleships, are probably of more general interest than the latter because both of the novelty of the type in our Navy and of the enormous power and high speed contemplated. These ships were each intended to have almost twice the propulsive horsepower fitted in any other vessel, merchant or naval, now in commission with the exception of that installed in H. M. S. *Hood*. The speed contemplated, viz., 33¼ knots, is about a knot greater than that attained by the latter vessel. According to the Navy Department* the degree of completion of these vessels as of September 30, 1921, varied from 2.7 percent in the case of the *Ranger*, building at the works of the Newport News Shipbuilding and Dry Dock Company, to 28.4 percent for the *Saratoga*, building at the works of the New York Shipbuilding Corporation. The keels of all six have been laid,** in several cases the lower part of the hull structure is well advanced and machinery is probably fabricated in the shops or on order.

Destruction of These Vessels Unthinkable

The scrapping, when the term implies the wilful destruction of the fabricated structure or material so far as its value for all marine uses is concerned, of these vessels is unthinkable in this day when the conservation of both money and human effort is the rule, provided, of course, a proper use can be found for it. In the case of the vessels farthest advanced the cutting up of the hull structure, clearing the ways and the removal of the scrap, together with the compensation to the contractors for the cancellation of contracts, might easily run into millions. When to this is added the loss due to scrapping propelling machinery, armor plate and guns (these two latter essentially military) the cost of scrapping as defined above becomes staggering.

In an endeavor to find a use to which the structure and machinery already under way may reasonably be put and in which the energies of the organizations already interested may perhaps be enlisted, the possibility of the completion of some or all of these ships as fast passenger liners at once suggests itself. Let us examine some of the characteristics which were contemplated in the design of these battle cruisers in an effort to discover the degree of their adaptability for this purpose. Reference has already been made to the enormous power of their propelling machinery and to their great designed speed. In order to obtain the best possible results from the machinery installed, the form of underbody has doubtless been the subject of exhaustive experiments in the experimental model basin at the Washington Navy Yard. It is believed fair to assume that for the purpose intended a practically ideal form has been secured. At a speed of 33¼ knots, the length (850 feet), as published, gives a value of $V/\sqrt{L} = 1.14$. The underbody coefficients suitable for this value of the speed length ratio and suitable also in large, long vessels for values of speed length ratio as low as 1.00 to 0.95 and their use for values as low as 0.85 would still be favorable to speed and fuel economy. This latter value, for a vessel of this length, would correspond to a speed of just under 25 knots, probably equal or superior to the highest sea speed of the best Atlantic passenger liners of today. Hence, from the standpoints of speed and fuel economy, the form of underbody of these battle cruisers is probably well suited to the speeds of the North Atlantic passenger service.

27 Knots Obtainable with One-Half of Power Plant

For the carriage of passengers the large machinery plant intended for the battle cruisers is not only unnecessary but, if used, would involve ruinous fuel consumption. A few figures based upon Taylor's data for powering ships indicate that a maximum speed of about 27 knots for an 850-foot ship of the Atlantic liner type having about 45,000 to 50,000 tons displacement could probably be obtained with a power plant half the size of that intended for the battle cruisers. Such an installation could easily maintain a sea speed of 24, 25 or even 26 knots. It ought to be entirely practicable to install comfortably such a plant in any of the hulls even though some rearrangement of bulkheads were required.

The vessels of this class were practically redesigned in order to embody, so far as possible, the lessons of the recent war. Among the most important of these lessons, according to expert opinion both in this country and abroad, is the necessity of close subdivision. A fair assumption seems to be that these vessels are strictly up to date in this respect. While it would obviously be contrary to the spirit of the proposed naval holiday to fit protective deck plating, armor, or turret foundations in the hull of a merchant vessel, it would seem entirely in accord with the latest ideas to safeguard the lives of passengers, while at sea, in every practicable manner and close subdivision of hull structure would, therefore, be of great value in a passenger carrying vessel.

Another point in favor of a hull constructed on the principles referred to in the preceding paragraph is the availability of the numerous small compartments for the satisfactory stowage of fuel oil, a large amount of which would be required to drive a vessel at the high speeds contemplated between this country and Europe.

Stability Sufficient for Additional Deck

The extreme beam of the battle cruisers is given in the Ship's Data Book, previously mentioned, as 105.4 feet, somewhat greater than that of any of the present day liners. If it were practicable to adopt this figure as the beam of the passenger liner to be developed, ample transverse inertia of water plane would probably be secured to make possible the piling up of the number of decks necessary for passenger accommodations and for adequate depth of strength girder. In fact, it appears probable that an additional deck could be carried as compared with the number carried by the other vessels of the liner type now in service.

In the absence of definite information as to the displacements of the battle cruisers at deep drafts such as 35 to 38 feet and the principal weights and tank capacities contemplated in the design, it is not possible to fix a deep load displacement but it is considered that this would not be far

*Figures published in Marine Engineering and Shipping Age for November, 1921.

**See Ship's Data Book, July 1, 1921, published by the Navy Department.

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from 50,000 tons. Such a displacement should be sufficient for the required amount of fuel oil, stores, passengers, etc., and it would probably provide for an amount of cargo comparable with that carried by other large, fast liners. If the relative lighter weight of naval machinery for the power developed, when compared with that of merchant ship machinery, be considered together with the smaller space occupied it would seem likely that space and weight for a relatively large amount of cargo could be provided. Inasmuch, however, as such spaces would probably be located amidships in the vessel's hold in compartments intended originally for boilers or machinery, access for the satisfactory handling of cargo might be difficult.

Deviation from General Methods of Design Unnecessary

In the foregoing it has been assumed that no difficulty would be experienced in designing suitable upper works for and in constructing them upon the battle cruiser structure now in place. An examination of the plans of several of the largest passenger liners now in service shows that the upper portion of the ship's girder is formed entirely of the vessel's shell and deck stringer plating. There is an utter absence of robust longitudinal bulkheads. This is, of course, largely due to the desire to secure space for passenger accommodations as free as possible from structural members. Such a design necessitates the fitting of very heavy topside plating. Following this general method it would appear entirely practicable to complete the hulls already begun as passenger liners.

The suitability of underbody form, the adaptability of part of the machinery installation, the value of the close subdivision for purposes of safety and for oil stowage, the ample beam, the additional stowage space gained because of the compact naval type of machinery, and the practicability of the development of a suitable hull structure have been touched upon in greater or less detail. There follows a table which emphasizes further by comparison with the finest vessels of the type now in commission the suitability of the suggested ship for the service in view.

It will be noted that the method followed in the treatment of the subject has dealt only with the engineering problem presented. The satisfactory solution of this problem alone by no means warrants the advocacy of the conversion suggested. The sanction of the armament limitations conference would be necessary in the first place. It would seem that there could be no legitimate objection to this method of utilizing the material and labor represented by these hulls and machinery plants when it is realized that as passenger vessels they would lack the turret foundations (to say nothing of the turrets and guns themselves), the horizontal protective plating and the side belt armor and conning tower and tube, as compared with the battle cruisers as designed. They would, moreover, be about 6 knots slower than the latter vessels and it would probably be impossible in an emergency to install additional machinery in the hold spaces available sufficient to attain the designed battle cruiser speed. An attempt to effect a conversion from passenger liner to battle cruiser in war time would probably be impracticable on account of the magnitude of the changes involved.

Cost of Conversion

Other things being favorable, the financial aspect of the subject remains for consideration. The terms upon which the hulls and machinery plants could be acquired from the Navy Department, the cost of their completion as passenger liners, and the possibility of successfully operating vessels of such size and speed under our maritime laws and in competition with the established and subsidized lines of foreign nations are among the considerations having a vital bearing upon the subject. Investigation would probably develop the fact that only through important governmental concessions could private enterprise complete and operate such ships. Perhaps nothing short of some form of governmental operation would suffice at the present time. In any event, however, the possibility of replacement ton for ton of every war vessel scrapped by efficient, up to date, merchant shipping in order to meet the demands of American business and convenience in the coming days is a subject demanding the most painstaking and enthusiastic study. Only through such study carried out with a determination to achieve tangible results can we hope to attain and retain a position of influence in international affairs at all commensurate with our national resources and opportunities.

Comparison of Principal Characteristics of Largest Ocean Liners With Battle Cruisers

Name	French Line	Cunard	Cunard	White Star	Battle Cruisers Completed as
Line	Paris	Mauretania	Aquitania	Majestic	passenger liners
Length, B. P.	735′	760′	868′-8½″	915′-9″	850′
Beam	85′-5″	87′-6″	97′	100′	105′-5″ assumed
Draft	31′ 1¼″	36′ 2½″	31′ 3″	38.5	35
Displacement	36,695	41,590	51,700	63,800	50,000
Speed Length Ratio	0.848	0.94	0.814	0.86	0.856
Block coefficient	0.658	0.602	0.609	0.632	0.558
Disp'l. Length Coefficient	92.2	94.6	79.2	83.0	81.5
Type of machinery	Turbine	Turbine	Turbine	Turbine	Turbine elec. red. gear
Type of boilers—fuel	Scotch D. E. oil	converting to oil	oil	watertube oil	watertube oil
Max. shaft horsepower	46,000	68,000	60,000	62,000	90,000
Max. speed	23	26	24	26	27
Sustained sea speed	20	24.5	22-23	23-23.5	*25
Number 1st class passengers	563	560	618	1,000	.....
Number 2nd class passengers	468	475	614	700	.....
Number 3rd class passengers	2.210	1,300	1,998	2,400	.....
Total number of passengers	3,241	2,335	3,230	4,100	Probably 3,200-3,500
Cargo capacity in tons of 100 cubic feet	**1,200	**1,200	**1,200	.....	Probably at least 2,500

*This figure tentative—subject to investigation as to service requirements.
**Rough estimate only.

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How Can American Ships Compete Successfully With Foreign Ships?

By Winthrop L. Marvin*

How can American ships compete successfully with foreign ships? It is a far-reaching question that is stated in these words, a question that goes right to the root of the life of our present-day merchant marine. For unless American ships can compete successfully with the ships of foreign nations, which still manage to dominate our own overseas carrying, there can be no future for ocean shipbuilding and navigation under the American flag. Believing that the future livelihood and success of thousands of energetic and ambitious Americans hang upon a right solution of the problem of the ship in service, the author presented his views on the subject in the following paper at the annual meeting of the Society of Naval Architects and Marine Engineers held in New York last month.

THREE main causes well known to men of our maritime industry were responsible for the inability of successful competition under the American flag with foreign ocean shipping previous to the great war.

For more than a hundred years the privilege of wearing American colors had as a general policy been reserved to ships of American construction. Coupled with this reservation, in the earlier years of our national life, was a vigorous national policy of encouragement to American ships—the discriminating duty policy, so called—which absolutely guaranteed to these ships a strong preference in employment. Under this policy, not completely abandoned until 1850 against our chief competitor, Great Britain, the requirement that American ships must be built solely in American yards was by no means an actual handicap. The building of wooden-hulled sail ships for a hundred and fifty years before the founding of our Federal Government had been a firmly established and successful industry in North America. Materials were abundant and relatively cheap, and the skill of our builders was unsurpassed—indeed unequalled. No American merchants of that era desired to purchase or use foreign-built ships, for there was generally no advantage in securing vessels from abroad.

While wooden sail-ships were carrying the commerce of the world, this requirement that vessels of the United States should be American built was a just and prudent policy for the republic. This policy was not substantially weakened or abandoned until the Panama Canal Act of August 24, 1912, which for the first time in a general measure permitted the registry of foreign-built vessels for the purpose of engaging in the overseas but not in the coastwise trade.

Cause of Decline of American Shipbuilding

Because of the absolute lack, from 1860 onward, of any comprehensive encouragement for the employment of American vessels in other than our coastwise commerce, there was only scant, precarious demand for the construction of such vessels, and American ocean shipbuilding became a weakened industry. I have long been convinced that in past discussion of the decline of the American overseas marine altogether too much emphasis has been placed upon the change from sail to steam and from wood to iron and then to steel. It is true that, in the period from 1840 to 1860, the British iron industry was greater than our own. British machine shops and steam shipyards were mightily encouraged and strengthened by the generous British policy of mail shipping subsidies, initiated in 1840 and maintained with vigor and persistence until competing American steam services were driven from the seas.

But American shipowners and builders were by no means so unmindful of the advantages of steam propulsion and iron hulls as some of the commentators upon the fate of our ocean shipping have contended. The iron propeller steamer *Bangor* was built on the Delaware in 1845, a thoroughly efficient vessel for that period. In the years between 1850 and 1861 good iron steamers were built on the Delaware, at New York and at Boston. Indeed, good American iron was found to be superior for shipyard purposes. The United States possessed admirable iron works and a substantial body of highly skilled mechanics, as was to be demonstrated later by the rapid and successful building of a fleet of monitors that proved a decisive factor in the Civil War. Not only monitors but broadside armorclads and iron cruisers were constructed in this country in the Civil War period, and a vast impetus was given to boiler and engine-making establishments at the Northern seaports by the swift creation of a new fleet of the six hundred war steamers that constituted in 1865 the most modern and formidable navy in the world.

Overseas Shipping Unprotected

All these facilities for the building of steam, iron, seagoing merchant ships could readily have been turned to the construction of a new merchant tonnage in 1865 and after, if there had been any positive aid and encouragement to the successful operation of these American ships after they were completed. But, though the dominant republican administrations of that period wrought a gigantic success in the protection and development of the manufacturing industries of the country, the overseas shipping trade of the United States was left wholly without any equivalent encouragement. What was more natural and inevitable, therefore, than that manufacturing should flourish and ocean shipping still further decline through those years when Great Britain, thanks to the depredations of Anglo-Confederate cruisers, had dealt a terrible blow to our sail tonnage and had possessed herself of that lion's share of our overseas carrying which she retained up to the outbreak of the World War.

Without protection to the operation of American ships, the continued protection to the building of such ships of course proved wholly ineffective. Though iron ship construction, particularly in the Delaware district, made respectable progress in the years following the Civil War, these new iron steamships were designed for the protected coastwise trade, except for a few large passenger and mail steamers for the Pacific Mail, four excellent transatlantic liners for the Philadelphia and Liverpool service of the old American Line, and other good but smaller steamers.

Under the sharply contrasting conditions wherein British yards were building in swift succession twenty iron steamers while our yards were building one—that is to say while

*Vice-president and general manager of the American Steamship Owners' Association.

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British yards were steadily manufacturing ships and our yards were producing irregularly a slender tonnage—what was more natural than that we should be seriously handicapped by a wide difference in the relative costs of construction? When in 1904-05 the Congressional Merchant Marine Commission under President Roosevelt made a careful survey of shipbuilding prices in this country and in Europe, the commission was constrained to report that steel steamships of the passenger and cargo type were costing from 40 to 45 percent more on this side than on the other side of the Atlantic. Under the circumstances, with no aid or protection whatsoever for American shipowners or operators, it was hopeless to dream of employing any considerable numbers of American-built ships in overseas commerce.

The Contrast in American and British Capital Charges

How heavy was that handicap can be demonstrated by a comparison of the capital charges of a British-built ship produced at a price of $500,000 and an American-built ship produced at a price greater by 40 percent, or of $700,000:

	British ship $500,000	American ship $700,000
Interest, 5 percent	$25,000	$35,000
Insurance, 4 percent	20,000	28,000
Depreciation, 5 percent	25,000	35,000
	$70,000	$98,000

Here, without any allowance whatever for the higher American wage costs of operation, is a difference in the main capital or carrying charges of $28,000 a year, or in itself a fair rate of dividend upon the total cost of the British-built vessel. This factor alone would suffice to bar the American ship from competition.

Moreover, the wages and maintenance of the officers and men of the American steamer were at least 50 percent greater than the wages and maintenance of the officers and men of the British steamer—a factor important of itself though of far less consequence than the handicap due to the higher cost of building as outlined above. It is not at all strange that from the building of the *Ohio* and her sisters for the Philadelphia American Line in 1873 the Stars and Stripes flew above no new American-built steamers exclusively employed in transatlantic trade until the keels of the *St. Louis* and *St. Paul* were laid by the power of a special mail subsidy in 1894 and 1895. Between far higher costs of original construction and higher costs of crew wages and maintenance, rivalry with European ships, often state-aided as they were, was accepted by American shipowners as impossible.

Government Aid for Foreign Shipping

When the shrewd diplomacy of Europe from 1815 onward had succeeded in enmeshing our Government in treaties that gradually prevented us from encouraging our ships through the historic policy of discriminating customs duties and tonnage dues, our competitors overseas lost no time in launching out on a new and effective expedient of their own—mail and admiralty subsidies and subventions. The first sustained British transatlantic steam service was created in 1839 by the grant of a mail subsidy of $425,000 a year to what is now world famous as the Cunard Company of England. Other subsidies, even larger in amounts, called into being the Peninsular & Oriental Line to India, the Royal Mail Line to the West Indies and South America and other British concerns, until finally thirty national steamship services reached all quarters of the world. France quickly followed suit. Germany put the powers of state aid, though in other forms than subsidy, behind the North German Lloyd and the Hamburg American. Our own Congress, in a fitful way, beginning with 1847, granted liberal mail pay to especial new American ocean steam lines, the best remembered of which are the Collins Line to Europe and the Pacific Mail to the Isthmus of Panama and on the Pacific Ocean.

But while other nations were united in loyal zeal for the national interests, it happened, unfortunately for us, that this new and crucial steamship competition fell in a period that saw America rent by the sectional quarrels immediately preceding the Civil War. Southern statesmen, who at first had borne a full share in urging encouragement to our own national mail lines, turned against them when they saw how swiftly these new lines were upbuilding the sea power of the North. In the very crisis of the struggle between our American lines and their European competitors, a hostile Congress, dominated by sectional prejudice, struck down the American mail subventions and thereby destroyed every one of the American steamship services in the transatlantic trade.

At this time the American Collins Line, with the largest and swiftest ships, was receiving a subsidy of $858,000 a year, and the rival Cunard Line $856,871 for smaller and inferior steamers. Soon after the Collins Line was killed by the act of our national lawmakers the Cunard mail pay was reduced by Parliament, demonstrating clearly that it was an aggressive fighting subsidy and nothing else.

But the British and other European policies of generous aid to national shipping lines, and thereby to steamship building and navigation, continued steadily without a break. It is sometimes urged that these governmental aids were not applied to "tramp" steamers. Directly they were not until France and Italy began to subsidize their entire shipping forty years ago. But, as a matter of fact, in a broad, true sense, these European subventions and other assistances in those earlier years did quicken and strengthen the then new arts of iron steam shipbuilding and boiler and engine building in such a way that even the "tramp" steamers that came afterwards were indirectly the beneficiaries of the system. Moreover, the subsidized national mail lines pioneered and created commerce a part of which the "tramps" subsequently carried.

The Ocean Mail Act of 1891

Until the United States in the Ocean Mail Act of 1891 tardily renewed the subsidy system in America, the decline of our own shipping remained constant. This Ocean Mail Law, though sadly crippled by Western agricultural opposition in its passage through the House of Representatives, did set the American flag again afloat on the great route across the western ocean and did permanently strengthen our steamship communications with the West Indies, nearby South America and Australasia. Services subsidized under the ocean mail law owned almost all the steam tonnage we had in ocean commerce when the great World War broke upon us in midsummer of 1914.

Turning from this survey of the past to the new present, what do we discover? Is there no more hope for successful American competition with foreign shipping than there was before the late great war?

For one thing, America has now what before the war it did not have—a large, actual, seagoing merchant tonnage available for immediate employment in overseas carrying. It has the ships and it also has the managers, the operators, the officers and the men. It is now conveying about one-third of our imports and exports, or three times the proportion of before the war.

The nation has 8,000,000 gross tons of newly acquired merchant vessels on its hands, ships in which all the American people are stockholders. These stockholders are unitedly determined that our ships worth having shall not pass out from under the American flag. Any political clique or party that consented to haul down the flag would be committing instant suicide.

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PRESENT OUTLOOK MORE FAVORABLE

So the general outlook of the present is immensely more favorable than that of before the war for the development of a great ocean shipping and shipbuilding industry. But the obstacles in the way are substantially the same obstacles —the higher cost of operation and perhaps of construction of American vessels, the fact that even now our foreign competitors are in possession of two-thirds of the field, and the further fact that these foreign competitors in some way or to some degree are all powerfully upheld by the active aid of their own governments.

It is not now possible to speak definitely and with authority as to the comparative cost of building ocean ships in America and in Europe. But it is true that shipowners who have made inquiry on the other side within recent months have found that British shipyard prices were lower than American prices by at least a margin due to the abnormal state of sterling exchange. On the other hand, the American yards could offer quicker completion and delivery, which in normal times is of itself a marked advantage. Altogether it will probably be found, when conditions in America and in Europe have again settled down, particularly with "tramp" cargo vessels, that foreign ship prices remain lower than our own, though by a narrower margin than before.

As to the costs of operation involved in at least the wages and the maintenance of the crews, Europe retains an undeniable advantage as contrasted with America. The La Follette Seamen's Law, whatever else it may have done, has conspicuously failed to equalize sea wage conditions around the world. Individual foreign seamen have quit foreign vessels in our ports and have reshipped on other vessels at the American wage scale. But this process, though not without significance, has not of itself brought foreign war scales, as a whole, up to American wage scales.

On May 1 last the pay of engineers, sailors, firemen and stewards on American merchant vessels, government owned and privately owned, was reduced by an average of about 15 percent. The ensuing strike was quickly and easily won by the Shipping Board and private shipping companies. On August 1, 1921, the pay of the deck officers of American merchant vessels was reduced about 15 percent, so far as mates were concerned. The pay of masters, with their greater responsibility, was reduced less, or not at all. Early in May a reduction in the wage scale of British officers and men became effective without a general strike. New present wage rates of American and British officers and men for cargo steamers of the same representative type compare as follows:

COMPARISON OF AMERICAN AND BRITISH MARINE WAGES FOR *CLASS C STEAMERS

American Wages effective from May 1, 1921, and British Wages Effective from May 6, 1921

Grade	American	British £	British £ at $4.86	British £ at $4.00
First officer	$195.00	26/10	$128.79	$106.00
Second officer	170.00	21/10	104.49	86.00
Third officer	150.00	17/10	85.05	70.00
Carpenter	85.00	14/10	70.47	58.00
Boatswain	80.00	13/10	65.61	54.00
Able seamen	72.50	11/–	53.46	44.00
Ordinary seamen	52.50	7/10	36.45	30.00
Chief engineer	285.00	35/10	172.53	142.00
First assistant engineer	195.00	26/10	128.79	106.00
Second assistant engineer	170.00	21/10	104.49	86.00
Third assistant engineer	150.00	17/10	85.05	70.00
Donkeyman	80.00	13/10	65.61	54.00
Oiler	80.00	13/–	63.18	52.00
Water tender	80.00	13/–	63.18	52.00
Fireman	75.00	12/10	60.75	50.00
Coal passer and wiper	65.00	12/–	58.32	48.00

*Class C, from 7,501 to 12,000 power tonnage—gross tonnage plus indicated horsepower.

Reductions in an equal or greater ratio have since become operative among officers and men of the Norwegian and Japanese merchant services, but the data for exact comparison with American schedules have not yet reached the United States. It can be said, however, that America is now paying wages far higher than those granted by any competing nations, and that the cost of food or maintenance is also markedly higher, so that in this respect there is no important change whatsoever from the economic conditions that prevailed before the great war. Sea pay, which rose during the war in Europe as well as in America, has since been somewhat reduced in Europe as well as in America, so that the difference between American ships and foreign ships in wage cost and operation remains substantially the same as it was before.

WAGE HANDICAP GREATER THAN EVER

In fact, allowing for abnormal conditions of international exchange, the wage handicap against American ships is greater than ever. Foreign steamers plying in American trade demand their freight or charter hire in American money, but buy their supplies as far as possible and pay the wages of their crews in their own depreciated currency. The result is astonishing. A case just reported to the American Steamship Owners' Association is that of a Norwegian steamer of a deadweight capacity of 11,000 tons. Her total cost of crew, including officers as well as men, per month, taking the kroner at 12.65 cents, is $1,613 a month, while the total cost of crew of a submarine boat type steamer, with a deadweight capacity of 5,350 tons, is $3,302 a month.

Of course the abnormal difference in cost of operation, due to the present state of international exchange, is temporary; it will not last forever. But for the time being it has the practical effect of a profound discouragement to American shipping and of an actual subsidy to foreign shipping which will have to be met in some thoroughly effective way, if American shipping is to live through the crucial ordeal of the three or four years to come.

Wages and maintenance together make up about 15 percent of the total operating costs of a modern freight steamer. The present cost of wages and maintenance to our British and Norwegian competitors, largely because of upset rates of exchange, is nearly or substantially one-half our own cost. This exceptional difference, of course, will tend to decrease as financial conditions are restored, but for the present this extra cost of wages and maintenance is a grave handicap to American shipping in a period of unprecedented intensity of competition. The difference in wages and maintenance is all the heavier a handicap on the new American merchant marine because America still lacks the well-coordinated mercantile and maritime organization all over the world which enables British shipowners to meet the competition of continental nations having wage rates still lower than the British scale. The effect of this close British co-operation in every country, in every trade and in every port, of British agents, merchants and bankers in enforcing preference for British ships, makes that shipping in effect one of the most thoroughly protected industries of which there is any record in commercial history.

SHIP AND SAIL IN AMERICAN VESSELS

All over the world British manufacturers and merchants and their representatives will be found demanding that British ships must secure all the cargoes which they can manage to control. There must be similar tenacious organization and cooperation of American manufacturers and merchants in the interest of their own country's ships and their own country's flag if our new merchant marine is to have the even chance to which it is honestly entitled.

Another important factor in the maritime situation, beyond the lower wage and maintenance cost of foreign ships and the disciplined activity of our competitors, is the generous direct or indirect national aid extended by all governments, particularly to their regular line steamship services.

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Just before the great war the United States Commissioner of Navigation published an analysis of the subsidies, subventions and bounties then being paid to the steamship interests of the world's chief maritime nations. These sums aggregated about $46,000,000 a year, of which Great Britain's own share was approximately $10,000,000. While the British and the Germans at that time gave direct state aid only for mail, passenger and fast freight services, it was significant that other governments, notably France, Italy and Japan, were subsidizing virtually their entire merchant marines and even giving direct bounties to shipbuilding.

As rapidly as possible, these subsidies, subventions and bounties are now being re-established—they were not necessary during the continuance of the war. It is probable that when the total sums of these state expenditures are again recorded they will be found amounting to a great deal more than $46,000,000 a year, for the war itself most vividly emphasized to all governments and all peoples the tremendous value, indeed the imperative necessity, of a strong commercial shipping for defensive and commercial purposes.

What We Must Do

What the American people must, therefore, prepare to do to enable American merchant ships to compete successfully with the ships of foreign nations is: (1) To find the most practicable form of equalizing American sea wages and costs of maintenance with the wages and costs of maintenance of foreign ships, by a system of preferential duties or subsidies and subventions, or some other still more effective method, if that can be found; (2) of organizing American manufacturers, merchants and bankers into a league as disciplined and powerful as the similar British league, for example, for securing the carriage of a greater share of our imports and exports to American ships; (3) of offsetting foreign subsidies, subventions, bounties and like national assistance given to the ships of our competitors. In addition, if it is discovered that the first cost of American-built ships is greater than the first cost of foreign-built ships, there must be full compensation for this factor also. In other words, the American merchant marine must be made what it has not been for more than sixty years, a nationally protected industry, as for most of the life of this republic manufacturing and agriculture have been protected industries. These things must all be done, or the new American merchant fleet, which is even now being beaten off the ocean by its competitors, will inevitably again decline and disappear exactly as the old merchant marine was declining from 1855 onward.

Moreover, it is essential that the classification and survey of American merchant shipping in the years to come be controlled by interests 100 percent American. The success of the American Bureau of Shipping is absolutely essential to the prosperity and security of the new American merchant marine which must also find in American hands the resources for a major part of the underwriting of the ships themselves and of their cargoes. Only the other day British marine insurance companies were assisting the Liverpool conference lines to retain complete control of the Egyptian cotton trade by allowing British ships much lower insurance rates on cotton cargoes than were being granted to American ships. The protective value of classification, survey and insurance of our own is a point that cannot possibly be overestimated in any study of the future of the American merchant marine.

American shipowners must develop, as rapidly as possible, what their fathers possessed before them, a corps of the most efficient seagoing officers in the world, every one an American citizen, and the largest possible number of citizen seamen. The American people will never consent to protect and encourage American shipping as it must be protected and encouraged so long as any substantial proportion of that shipping is officered and manned by alien subjects of foreign countries, our rivals in trade and possible enemies in war. Who can justify a merchant marine as a naval reserve unless it is securely held in loyal hands, and not in the hands of those who in an hour of need might betray it to the enemy?

Financial Statement of Shipping Board

A STATEMENT of the assets and liabilities of the Shipping Board as given by Chairman Lasker in testimony at an executive session of the Senate committee on commerce and the House committee on merchant marine and fisheries has been made public. The statement is as of July 1 and does not include unexpended appropriations, the fleet, or contingent cases and admiralty claims. The statement shows total assets amounting to $307,000,000 and liabilities amounting to $115,000,000, so that if the various claims against the board should run as high as $200,000,000, as estimated, it would have the fleet left. The assets as of July 1 were as follows:

Assets	
Cash	$33,000,000
Accounts and notes receivable	33,954,000
Accounts receivable of managing agents	9,360,000
Operating supplies	10,850,000
Surplus materials for sale, inventory value	35,561,000
Land, structures and equipment for sale	42,229,000
Mortgages receivable and securities	10,865,000
Notes receivable from ship sales (unsecured)	16,375,000
Notes receivable from ship sales (secured by mortgages)	98,997,000
Real estate and equipment used in operation	3,967,000
Total	$307,400,000
Liabilities	
Accounts and vouchers payable, accounts payable of managing agents, accounts payable for charter hire and refunds of deposits and collections	$71,482,000
Mortgage bonds and mortgages payable (obligations assumed on acquisition of property)	2,109,000
Reserve against value shown in inventory of surplus materials and lands, structures and equipment	42,287,000
Total liabilities, exclusive of claims	$115,878,000

The statement is regarded as important as the first of the kind that has been made to indicate to the board its financial status.

Egyptian Cotton Controversy Settled

One of the outstanding developments of the month of November was the settlement of the Egyptian cotton dispute. The Liverpool lines conference has agreed to the allocation of 50 percent of the tonnage in both the direct and indirect trade of Egyptian cotton to American vessels. They had previously proposed to give 50 percent of the sailings in the direct trade to American vessels, but this would not necessarily have meant 50 percent of the cotton and until now they have positively refused to grant any portion of this cotton going by the way of the United Kingdom to American vessels.

Regular Commercial Schedules

Chairman Lasker has decided to maintain the schedules of Shipping Board steamers so that they will conform to the best foreign practice. This will place our vessels in a much stronger competitive position and enable them to give the merchants in this country greater facilities for doing business. It will also inspire greater confidence in the operation of government tonnage. This action will be of the greatest benefit to exporters throughout the country, and it is confidently expected that materially increased support of American flag ships will be immediately forthcoming.

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Present Indications Regarding Ship Operation

By Robert E. Annin

The successful operation and management of ship property involve factors so complex and far reaching as to require a grasp of conditions, prospects and possible influences broader, perhaps, than is needed in any other purely commercial vocation. Either ownership or management contain speculative elements which cannot be evaded. Capital once put into tonnage is fixed. Its profitable employment depends, in large part, on factors altogether beyond human control.

IT is the consensus of trained opinion today that not in modern times have conditions, influences and uncertainties created so confusing and perplexing a situation as now prevails for either owners or managers. These conditions extend to the very roots of industry, the prosperity of which is, of course, the essential basis of a prosperous commerce.

In every commercial community the dominant questions are: how much further are the reactions of the war likely to go; and how soon may the hoped for, and longed for, improvement be expected to set in? Speculation on this subject extends from the broad fundamentals to the conditions and prospects in every trade (and the opinions expressed are almost as numerous as the individuals expressing them).

Even now, however, certain facts and tendencies are emerging rather clearly from a badly confused situation. Notably the uncertainty of trade policies on the part of the great trading nations is likely to discourage the initiation of permanent and far reaching plans involving heavy investment. Even England and the United States appear to be considering changes in national policies so long pursued, that they had come to be tacitly considered as permanent by the generality of observers.

Change in Position of Tramp Steamer

Another item, which from the owners' and operators' viewpoint seems fundamental, is a change in the position of the tramp steamer. Such ships have been the backbone of the oversea commerce of all the great maritime peoples—notably England and Scandinavia—and have on the whole proved to them highly profitable. But today it would appear that the best days of the occasional voyager have passed and the business of oversea transportation is likely to tend increasingly toward lines giving regular and established service over permanent routes. Of this tendency the indications seem not only unmistakable but they are rooted in the economic drift of modern business, large and small. They are as inevitable as (for example) the concentration of land transportation, over the quickest and most economical routes, by vehicles carrying the heaviest loads at the least per ton overhead and operating cost. They are in line with the universal modern tendency to attempt economy through the organization of large rather than small operating units.

To illustrate: in 1895 (26 years ago) the handiest type of tramp steamer for a typical steady trade was what was called the twelve- or fourteen-load ship. This meant that steamers carrying from 2,500 to 2,900 tons of weight cargo were more profitable for irregular trade than either a larger or a smaller unit. In those days a twenty-load tramp (say 4,200 tons cargo weight) was considered large, and one of twenty-four-load capacity rather exceptional.

From 1895 on, the average size of tramp steamers has increased steadily, until today a grain charter under twenty loads is exceptional, twenty-five loads is ordinary, while anything up to forty loads does not attract attention as unusual.

This trend at least is obvious. The world's tonnage has constantly progressed toward the larger individual unit. The chief causes are clearly twofold. First, the smaller ton-mile expense (both overhead and operating) of the larger ship; and second (resulting therefrom) the progressive enlargement of facilities throughout the competing ports of the maritime world. Contributary to these is the general tendency of land transportation to seek the cheapest terminals; and the struggle of rival ports to provide facilities adequate for the largest volume of both land and water traffic.

Trade Follows Economic Lines

That the latter proceeds along economic rather than national lines is not only the teaching of commercial history, but is also clearly indicated by current developments. For instance, it is of public knowledge that a scheme for deep-water traffic via lake and canal to and through a Canadian port, in competition with New York and Boston, is securing support in over a dozen states in the western section of the United States. And it is to be further noted that the same port (Montreal) during the season now passing nearly monopolized the outward grain traffic of the Atlantic coast of North America, until its facilities became insufficient for the traffic which sought to move through that terminal.

The abnormal demand springing from war causes now being a thing of the past, it seems evident that the limit of economical size for occasional cargo carriers has for the present been reached. Grain, a most vital business for the tramp, is a seasonal commodity; therefore owners cannot base their calculations on the assumption that their ships will always, or usually, be employed in that traffic. Hence the tramp of the present and (presumably) of the immediate future must endeavor to strike a mean size, which in operating economy shall not be too small for the needs of the grain trade, nor too large for the average shipper of other bulk cargoes—ore, lumber, sugar, coffee, general cargo, etc. Especially during the period of depression in international commerce, tramps will require the support of many different trades and specialized types will be difficult to handle. Even during the recent English coal strike, when there was an eager demand for spot tonnage, it was difficult to place tramps of over 7,000 tons cargo capacity and often impossible to secure charters for ships of 9,000 tons and up.

Advantages of Regular Lines

The limit of size for liners, on the other hand, is fixed by only two considerations—the facilities at terminal ports and the average volume of cargo to be moved. This, combined with more permanent, economical and efficient machinery for obtaining, loading, discharging and transshipping cargo, give to the regular lines an increasing advantage as trade becomes more highly organized. True, they have special and large expenses in the maintenance of a relatively costly organization, but this again is offset by other factors—greater regularity of employment, lower per ton expense of transportation and the good will of an established clientele. The last is an asset none too great at best in so highly competitive a business as export or import, and almost non-existent as relating to casuals.

Again, the large freight liners are able more efficiently to specialize for the carrying of perishable goods or other cargo

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requiring special provision and hence paying relatively high rates. In such trade, of course, superior speed insures a preference. The combined freight and passenger liner is looming up as a "dual purpose" ship which may easily find profitable employment when the pure cargo carrier would starve to death. In this connection it is significant that some of the oldest and largest transatlantic lines are building fast passenger steamers with generous provision for cargo—a rather recent departure for some of them. As a present influence, the collapse of the Baltic and Black Sea business, always a most important field for tramp service, must be reckoned with. How long it may be before this trade comes back to anything approaching a normal demand is any man's guess. Until then, the tramp tonnage thus displaced must react on the whole situation.

All in all it appears that future developments in ocean transportation will be such that tramps will occupy a much less important place than heretofore. The tendency will be to push them into feeder service. Certain lines of bulk commodities will always require full cargo charters, owing to special conditions. But the heyday of the tramp appears to be over, barring, of course, fresh and unexpected developments which shall neutralize the influences which are now so much in evidence.

MOTORSHIPS

Other, and even more vital, changes are perhaps impending. The steady progress of the internal combustion engine is a fact of great significance. The average steam engineer, with the conservatism of his kind, has been inclined to view this as an interesting but more than doubtful experiment, unlikely seriously to threaten the dominance of the steamship at least for many years. A few successful and comparatively short trials of any novelty do not warrant conclusions on which far reaching plans can be based. But the so-called motorship seems to have passed out of the experimental and into a highly practical stage of development. In other words the motorship, formerly a question chiefly for engineers, is entering upon a period where it becomes a large practical question for operators, and growing records of actual service are attracting increasing attention. Not only do many of such records measurably bear out the claims made for this type, but evidences of the conversion of experienced steamship owners multiply. Reports of remarkable achievements have been common for some years; but trial trips and short voyage records are not convincing in a matter where sustained performance, maintenance costs, replacements and the indications as to length of competitive life are of the essence of the problem.

One recent record of achievement, recently published, seems, however, worthy of special notice. The tanker *Narragansett,* built by Vickers at Barrow, and with a total deadweight capacity of 10,000 tons, is said to have accomplished in twelve months service an average speed of slightly over ten knots on slightly less than ten tons average daily fuel consumption, against an estimated consumption of 35 tons per day with oil burning steam machinery. After covering 60,000 miles in Atlantic service, her engine repairs are stated to have been trifling, while the performance of the ship in other respects was entirely satisfactory to her owners.

Of an American built ship of this type, it is reported by her operators that on the completion of six months continuous service (as yet uncompleted), she promises to show an *operating* profit of $100,000 as against an estimated net loss of $6,000 with coal burning steam machinery.

COMPARISONS NOT NECESSARILY CONCLUSIVE

These comparisons are not necessarily conclusive but they are certainly of interest to the operating end of the business. Once established, any type of engine that can avoid from one-half to two-thirds of the ordinary fuel expense of competitors must push its way rapidly by the mere force of economic selection. How rapidly such an advantage might become a decisive factor may be judged from the recent strides made in the construction of oil burning steamers as against coal.

According to the last annual report of Lloyds Register, the afloat tonnage of the former in 1921 was nearly ten times that of 1914. Comparisons are stated as follows:

1914	Oil burning steamers.....	1,310,000 tons
1921	Oil burning steamers.....	12,800,000 tons

The same report states that of all the ships classed in the year ending June 30, last, no less than 58 percent were oil burners (not including older ships converted from coal to oil).

On the same date 50 motorships were reported under construction in the yards of the United Kingdom.

Under existing conditions the replacement of steam by internal combustion engines would be slow, even if the experimental stage on the latter were admittedly over. The inducements for new investment in the field of ocean transportation are at present meager and for some time to come are likely to remain so. The heavy additional expense of installation will be a deterrent; and for the near future at least the scarcity of engineers familiar with this type of engine.

But there is every prospect that, in the replacement of tonnage, the motorship will receive increasing consideration. Thus far the proportion of this type in operation has not been sufficient to be an influential factor in fixing the level of freights. But when and if such proportion increases, the influence on rates will necessarily increase also and the matter will become of vital import to owners and operators of every class of ocean carriers.

Such innovations may have an important effect on the question of bunkers. That cheap fuel is the most important physical factor in operating costs is axiomatic. If it were not, the ledgers of operators during the last six years would have proved it to demonstration.

ECONOMY OF OIL FUEL

Oil, as a fuel, has been rapidly displacing coal because the greater *per ton* production of power and the resultant increase of revenue producing capacity have more than offset the higher per ton cost. There are other factors, such as economy in loading, saving in wages, subsistence, etc., but the two items above named are the main factors. Clearly, therefore, the advantage of oil tends to disappear with any *relative* advance in price (as compared with coal) and with progressively declining freight rates. The latter of these factors is now much in evidence. The former may be impending. In fact the recent general advance in oil prices, while nearly every other commodity has declined, suggests that both influences are now to be reckoned with.

The demand for oil as a power producer is increasing by leaps and bounds in all directions. As a lubricant, at all capable of meeting an increasing demand, no efficient substitute for mineral oils is in sight. Therefore, if we assume a steady price for bunker coal, at or about present prices, and a continued advance in mineral oils, the point is not far off when the former will again become the cheaper fuel.

In this matter it is not necessary to guess how distant the "exhaustion" of the world's oil supply may be. For purposes of the present argument the only pertinent question is "How long can the superior efficiency of oil (all things considered) offset the higher per ton cost?" In view of the discouraging outlook as to freight rates, and present relative costs of the two fuels, this turning point may possibly, from an operator's standpoint, be very near. So far as concerns increased revenue, due to the release of cargo space and lift, this will be largely theoretical, as long as ships sail with partial cargoes one way and return in ballast.

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Transferring Transport Service to Steamship Lines

By Waldon Fawcett

A point that has been forcefully brought out in the discussions on the Edmonds Bill is that not only has the Army Transport Service, as heretofore conducted, been withholding the support that might fittingly be furnished for the establishment of permanent steamship lines, but it has, all the while, been robbing the merchant marine of a share of its income from civilian passengers. The diversion is due, of course, to the abuse of the privilege whereby passengers are carried on Army transports for a nominal fee—formerly $1 per day, latterly $1.75 per day.

IF only the opposition of the War Department can be overcome, there will shortly be imparted a worth-while new stimulus to the development of the American merchant marine. This promising innovation contemplates the discontinuance of the Government transport service and its replacement by permanent steamship lines, operated under contract by private interests. The Navy Department, notoriously more progressive and farther-sighted than the War Department, is heartily in favor of the contemplated change. But the Army, with something of that selfish autocracy of which it cannot divest itself even in time of peace blocks the project, although it was long ago recommended by the ablest Secretary of War of the generation.

Impatient at the perversity of the Army officers who are loath to relinquish any of their perquisites, Congress proposes to take a hand. Pending in the House of Representatives is a bill (H. R. 5348), introduced by Congressman Edmonds, that would to this end amend sections 17 and 19 of the Merchant Marine Act of 1920. Extended hearings have recently been held upon this bill at which the sentiment in merchant marine circles was voiced by representative steamship owners. However, the Merchant Marine Committee of the House defers recommendation to the lower branch of the national legislature pending a report from the Shipping Board which is now investigating the proposition from the standpoint of the obligations that would be imposed upon this institution.

Basis for Permanent Steamship Lines

The new paragraph which the Edmonds bill would insert in the Merchant Marine Act would authorize the Shipping Board to, whenever possible, utilize the transport of the Army, Navy or Marine Corps as a basis for the establishing of permanent steamship lines. Where such opportunity presents the President is empowered to discontinue transport service by the Government and contract with the new service for a period not exceeding ten years. It is stipulated that no contract shall be made with any steamship company whose ownership is less than 75 percent American and it is also requisite that all the contracting companies' ships, owned directly or through subsidiaries, shall be registered or enrolled under the laws of the United States.

Coupled with the foregoing in the pending bill is a second section which, at casual glance, might appear to have no connection with the replacement of the transport service but which, as will hereafter appear, has definite contact with the main issue. This second stipulation of the Edmonds bill is to the effect that any contemplated extension of service by the Panama Steamship Company shall be submitted to the Shipping Board for approval and all extensions of service made by this company since in control of the Government shall be approved by the Shipping Board or discontinued and all freight rates established by this company shall be in agreement with rates established by the board for its operators and be subject to the approval of the board. A perusal of this second half of the bill will reveal, if the first part did not, why the Congressional committee awaits the comment of the Shipping Board before pressing the pending measure.

Constructive Possibilities

Representative George W. Edmonds of Pennsylvania, author of the bill that proposes to provide additional profitable employment for the American merchant marine, has strong faith in the constructive possibilities of the proposal. He feels that, by this means, the Government may without recourse to subsidies, or subvention or anything of that sort, utilize its normal and inevitable expenditures for transport service to build up steamship services that are needed and that might be expected to continue even though there was fluctuation in the volume of military or naval movement.

"My idea," said Congressman Edmonds, not long ago, "is to go to a steamship line or have a steamship line come to the Government and say: 'You are using one ship a month between San Francisco and Manila—with its ramifications up to Nagasaki or over to Shanghai or Tientsin—and we are willing to make a 10-year contract with you to do this service.' If such a contract were made then you have basically done something for the steamship company that they can count on as a positive income to utilize toward building up a service or a line between the two countries, the idea being to abandon the transport service of the Army and to contract with a steamship line to carry the men.

Not An Innovation

"This is not any new thing; it is not a new thing of mine. England has always done this in building up lines to her colonies and Japan is doing it today. I traveled on Japanese steamers over in the East and I found these contracts with the steamship companies and Japanese officers and privates traveling on those steamers. It is my idea that in this way we will build up a permanent establishment, because it will provide a steamship line with an income from the transport service and then the company will start to build that service up with other freight and other passengers. England is using such service to South Africa and in Australia and there is no reason why, in making contracts with steamship lines, you could not provide for the use of the steamers in time of war. If there is a man who would come to me and offer to do this service at the same price, and I know that I can accomplish the establishment of a steamship line between certain points, I can not for the life of me see why he should not be allowed to do so. This plan will not cost any more money—and the men in the Army know it as well as I do."

Army officers who have advised Congressmen with respect to the Edmonds bill have contented themselves with the objection that there is nothing in the plan that would lead them to believe that the service will be any better or that the service will be any cheaper than at present. They have missed entirely the constructive note that has been struck by the members who are pushing the bill, and have assumed that the dollars-and-cents aspect, in its immediate applica-

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tion, is all that concerns the national legislature. Other than this the only argument advanced by the chief of the transport service of the United States Army to warrant continuance of the present system is that it builds up an Army personnel in time of peace that knows something of the routine of handling troops at ports of embarkation and also the methods of getting them on and off the ships.

AGREES WITH POLICY OF JONES BILL

Probably the most forceful presentation that has been made at Washington in behalf of the Edmonds bill was that of Mr. Winthrop L. Marvin who, as general manager of the American Steamship Owners' Association, spoke for the entire membership of that body comprising about seventy American companies operating and owning ocean steam shipping under the American flag to the aggregate of 3,000,000 gross tons. Mr. Marvin, in conference with the Merchant Marine Committee, made the point that Congress was virtually committed to the policy exemplified in the Edmonds bill because, by the Merchant Marine Act of 1920, the legislature, in effect, declared for an ultimate policy of private ownership and operation. If an end is to be put to all competition between Government-owned shipping and the fleet controlled by private capital and enterprise, supplementary policies such as that contemplated in the pending bill are actually essential.

There has been instanced at Washington the fact well known to every person at all conversant with the subject that the Army transports have been crowded at every trip with persons in no way connected with the Army and with the most distant relatives and most remote connections of Army officers. There was discussion in the Merchant Marine Committee, anent this abuse, of the junket of a ship load of school teachers to Porto Rico on the first transport built at Hog Island. And as an illustration of what has been going on there was cited the spectacle of the Philippine delegates to the Congress of the United States, collecting $30,000 in mileage and traveling back and forth across the Pacific on the Army transports.

On behalf of the steamship owners it has been pointed out to Congress that the ownership and operation of transport steamers by the United States Army and Navy were due, originally, to conditions which no longer exist. The Army transport service to the Philippines and Panama and the Navy transport service to Haiti, San Domingo, Samoa and Manila were all established prior to the World War when the merchant marine of the United States was far more limited in its resources than at present. The War Department and the Navy Department were virtually compelled to establish their own services because of the lack of adequate privately-owned shipping facilities. There is apparent reason to declare that it was never contemplated that these Government shipping services should be permanent.

PRIVATE LINES CAN HANDLE TROOPS AT LESS COST

Steamship operators have no intention of allowing Congress to remain in ignorance of the motives of Army officers in opposing the surrender of any of the existing transport service. It is recalled that as far back as 1902 Elihu Root, then serving as Secretary of War, made the significant statement: "I am satisfied that it is practicable for the private shipper to do ordinary business much cheaper than it is possible for the Government to do it under the limitations which rest upon Government action, and that they can afford to do the business for less than it costs the Government and still make a profit." And now, after two decades, we find the present director of ship movements of the United States Navy Department substantially concurring in this view and stating that the Navy Department prefers to use space in merchant shipping and does so whenever it can. Furthermore this naval authority has, within the year, stated to Congressmen that not only does the Navy feel that it should not operate vessels where they will compete with merchant vessels but that the Department realizes that it can not operate them as economically as cargo space can be obtained from well-established lines.

CAUSED ABANDONMENT OF TRANS-PACIFIC SERVICES

Stubborn, selfish insistence by Army authorities upon the operation of their foreign-built transports on the Pacific in the face of Mr. Root's recommendation and in defiance of the no less emphatic expression from a Congressional merchant marine commission appointed in 1905 upon the initiative of President Roosevelt was, according to evidence just placed before Congress, "a powerful contributing factor" to the final abandonment of American trans-Pacific services out of Puget Sound and San Francisco and the sale of the ships formerly in those services to foreigners. Thus, in the words of Manager Marvin, the War Department made victorious war not only upon the American merchant marine but likewise upon the auxiliary cruisers of the Navy Department.

It is being impressed upon Congress that the transfer to the American merchant marine of the financial support that now goes for naught in the operation of the transport service is no minor matter but a move for self-preservation that is imperative, if the American merchant marine is to survive on the Pacific. In no other way will United States mail, passenger and freight steamers have a chance to live against the subsidized, cheap-wage competition of the paralleling Japanese and British lines. Solemn warning is given that conditions in the Pacific just now are such that the breaking down of the American services and the driving off of the Shipping Board's commercial lines might prove a national calamity.

PACIFIC COAST SHIPS ONLY PARTIALLY LOADED

Speaking in behalf of the Pacific Mail Steamship Company, Mr. Robert H. Patchin at a recent session called the attention of the Merchant Marine Committee of the House of Representatives to the fact that at the present time all of the nine large passenger-carrying vessels operating in the trans-Pacific trade are sailing from the Pacific coast only partially loaded because of the operation of United States Army transports in direct competition with them. To the same end, the Pacific American Steamship Association has made the point that the present competition merely makes both Shipping Board and Army vessels unremunerative at public expense. The burden on the taxpayers of the country is, of course, particularly heavy in the case of the Army transports which, by reason of taking cargo in but one direction and maintaining separate terminals and operating forces, have a high overhead as compared with merchant vessels in regular trade.

A clue to what is in the Congressional mind was supplied when representatives of the Pacific lines, appearing at Washington, were asked by committeemen at the Capitol whether, if they were enabled to obtain the business now being handled via Army transports, the companies would purchase vessels from the Shipping Board to supply this service. When no assurances on that score were given by the shipping men, Congressmen inquired whether, if the transport business were thrown to them, the ship operators on the Pa-

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cific, who have announced their ability to handle this traffic, would give up their present M O 4 contracts with the Shipping Board and, accepting instead bare boat charters, would operate vessels without guarantee of a percentage profit.

PANAMA STEAMSHIP COMPANY

The second section of the Edmonds bill, that designed to bring the policy of the Panama Steamship Company into harmony with Shipping Board policies, might appear at first glance simple in purpose and direct in method but in reality it has behind it a complex issue, to explore the controversial phases of which would require many pages of this journal. Alike to the other section of the bill, inspiration came from a seemingly trivial incident. The report that the United States Army contemplated an extension of its present transport service spurred the friends in Congress of the United States merchant marine to make effort to end once and for all the insidious competition. The reputed action of the Panama Steamship Company, in going out of its normal sphere of operations and underbidding Shipping Board vessels by $2 a ton for the movement of phosphate from Tampa, served to bring about the present deliberate effort to bring the Panama line within the jurisdiction of the Shipping Board in matters of freight rates and operating policies.

Testifying at length before the Merchant Marine Committee, Mr. Thomas H. Rossbottom, vice-president and secretary of the Panama Railroad Company, has acquainted Congress with all the circumstances and influences that induced the executives of the Panama Steamship Company to adopt the traffic policy and the rates which have been "under fire" in the shipping world. He declared in so many words that all the projects for the gradual extension of the services of the Panama Steamship Line, regarding which so much has been heard, are "dreams" of certain newspapers and two nautical journals. Nevertheless, members of the Merchant Marine Committee made clear their realization that on many a route in the Caribbean and in South and Central American waters there is room for only one line to operate profitably and that no private line can hope to compete with a line for which the Government furnishes the capital without interest or other charges.

Various expressions have been made to the Congressional committee of the position of the private interests operating in the West Indies and Latin-American waters, notably the recital of the position of the Clyde Steamship Company made a few days ago by C. H. C. Pearsall, general manager of the foreign services of the Clyde Company. Mr. Pearsall has detailed graphically the history of the entry of the Panama Line into Haiti and of its cut of 25 percent under the rates of the private line, thereby forcing that private line to carry the freight to the outports at a reduction of 25 percent, though that private line only participated in 40 percent of the possible volume. All the shipping men who have contributed to the discussions have declared that if United States trade in the West Indies is to be developed through the instrumentality of private lines there must not be Government competition.

Proposed Plans For Revision of the Navigation Laws

Adoption of Merchant Shipping Act of Great Britain Advocated— A Precedent Found in Action of Navy Thirty-Five Years Ago

By C. A. McAllister

THE problem of devising ways and means to assure the permanency of our merchant marine is still an acute one. Depression in the world's business is felt more in ocean shipping than in any other branch of industry. With most of our shipyards idle and with over two-thirds of our merchant fleet tied up, there is now ample time and opportunity to discuss ways and means to put the facilities for our sea commerce in order, so as to be ready for the revivification of ocean carrying when brighter times come, as come they must.

No matter what schemes may be advanced by interested parties to accomplish the desired permanency of operation, there is, and has been for many years, the underlying feeling among shipping people as well as with the public at large that our navigation and steamboat inspection laws are accountable for holding back our development on the seas. With such a universal belief, it is quite patent that something should be done to investigate the matter and furnish relief to our shipowners, if relief is really found to be necessary.

CONSIDERATION OF NAVIGATION LAWS NOT OVERLOOKED

It is generally supposed that the Government has been remiss in its duties, so far as this important subject is concerned. Such is not the fact, as when the bill creating the Shipping Board was passed back in 1916 it was made the duty of that body, among many other requirements, to investigate the navigation laws and to report to Congress what changes, if any, were necessary to remove any discriminations against American vessels. It is now a matter of history that shortly after the Shipping Board began to function we were plunged into the world war and all functions of the Shipping Board, other than those necessary to provide ships with which to help win the war, were, of necessity, sidetracked. However, in the fall of 1919, the Shipping Board took up that portion of the law requiring it to investigate our navigation laws and after due consideration decided that it would be better to have a committee of experts to report upon conditions as they were and report to the board such changes as it might deem advisable.

SHIPPING BOARD COMMITTEE APPOINTED

The committee was duly appointed and consisted of Mr. Franklin (chairman); Mr. Ferguson, of the Newport News Company; Mr. Kirlin, the Admiralty lawyer; Mr. Smith, president of the Ward Line; Mr. Furuseth, of the Seaman's Union; Mr. Brown, president of the Marine Engineers Association; Mr. Warden, then of the Standard Oil Company; Captain O'Donnel, of the Sprague Steamship Company; Mr. Alexander, of the Pacific Coast Steamship Company; Captain McGray, of the Neptune Association, and Mr. Delancy, of the Shipping Board. The writer was appointed as secretary of the committee.

During the winter of 1919-1920 this committee functioned as best it could during the period of inflated prosperity in all branches of industry which followed the world war. All of the members devoted as much of their time as their very important private business interests would permit. The committee was actuated by but one motive and that was to investigate matters as impartially as possible and to make

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their recommendations for the very best interests of the American merchant marine. There was at all times, among all of the members, a sincere desire to do justice to every element interested in the subject.

EXTENSIVE DATA COLLECTED

At the time the meetings of the committee were commenced, the widest publicity was given to its objects and constructive suggestions were invited from all interested persons. Following this appeal many of the leading men in shipping and its allied industries presented their views to the committee for its consideration. These constituted the basis upon which the investigations and recommendations of the committee were made. It was impossible, naturally, for a committee composed of men of such large business interests to go into all the details of the subject, hence its reports and recommendations have been confined to items of major importance.

It is not within the province, and far from the desire of the writer, to divulge what these recommendations have been, as the committee holds that its relations with the Shipping Board are entirely of a confidential nature. It is, nevertheless, due the public to be advised that these recommendations will form the basis of re-codification and revision of all the laws relating to shipping, which the Shipping Board is having prepared by a special Admiralty counsel appointed by the board. It is understood that when this work is completed, the new code will be presented to the Congress for its consideration and action. Work of this kind is necessarily arduous and complicated, as it is absolutely essential that it be done thoroughly and accurately. The work of revision is now well advanced and should be presented to the present Congress.

Entirely disassociated from the membership of this committee and its reports, which were filed with the board over a year ago, the writer learns from various associations among shipping men that there has recently been a growing sentiment among people interested in our shipping activities to the effect that the surest and best way to place our merchant marine on an equal footing with our shipping rivals is for Congress to adopt for all our vessels in the foreign trade the Merchant Shipping Act of Great Britain. The men who favor this procedure have in no instance been those who can be called pro-British in thought or action; on the contrary, some of them I have talked to on the subject are the leaders in the demand for a strictly American merchant marine in every particular and have proved by their action that they are sincerely devoted to the upbuilding of our own shipping.

MERCHANT SHIPPING ACT OF GREAT BRITAIN ADVOCATED

They base this contention for the adoption of the Merchant Shipping Act on the fact that Great Britain is the premier maritime nation in the world and besides knowing the business thoroughly has by far the largest fleet of merchant vessels. The laws which have sufficed in the building up of this shipping supremacy must be such as to have given the British shipping all necessary protection, without in any way hindering its development. It is frequently claimed that, so far as governmental regulation is concerned, our ships are at a decided disadvantage when compared with British vessels. Very well, then, why not adopt the very laws which gave the advantage to British vessels over our own vessels? Our common law is based on the common law of England. Because they are British laws is no reason why they would not work just as well on our own statute books. Imitation is said to be the sincerest flattery and there seems to be no good reason advanced why we should not avail ourselves of this code of maritime laws, built up with years of successful experience in operating ships in the foreign trade, which we, as a nation, have not had for over fifty years.

ACTION OF THE NAVY ESTABLISHES A PRECEDENT

About thirty-five years ago we began to construct our so-called New Navy. For a period of over twenty-five years up to that time, naval construction in this country had been a lost art. Great Britain had been compelled then, as always, to keep her naval efforts up to the top notch. As a result she had far outstripped us in the efficiency of war vessels. The then head of our Navy Department, for a comparatively small sum, purchased from English firms complete detailed designs for an up-to-date battleship and several large cruisers. A great howl arose in many quarters in this country about the alleged unpatriotic act of purchasing plans abroad for our war vessels. The contention was that, despite our inexperience in warship construction, we could, unaided, produce designs to equal or better the British designs.

The writer was then connected with the Navy Department and worked on plans used in the construction of many of our new war vessels. The purchased plans were consulted by all and proved of the greatest value. By getting these plans we had secured the accrued experience of people who had been following that line of effort during a period of a quarter of a century, while we had done nothing. Our designers were not to blame because they had nothing to build during that period of inanition.

With the start obtained by thus adopting the experience of others, our naval designers soon became absolutely independent and now for many years the designs of our naval vessels, strictly American, have been sources of pride to our own people and of admiration of our rivals. To recognize that which is good and worthy of emulation in others is not unpatriotic by any stretch of the imagination; on the contrary, it is entirely logical, and an evidence of good common sense.

REVISION OF NAVIGATION LAWS A PARALLEL CASE

The matter of navigation laws is, in the writer's opinion, almost a parallel to the naval construction incident herein quoted. During the long period in which we were somnolent in foreign shipping Great Britain has forged ahead. Now that we are striving again to take our place on the seas what is more logical than to adopt her best methods, to the end that, as we gain experience, we may equal or better her, insofar as getting and holding our just proportion of the sea-carrying trade of the world is concerned?

American ships should have every advantage and privilege given to the ships of other nations and as much more as we can give them. When the matter of revising our shipping laws reaches Congress, let us devoutly hope that they will carefully consider all phases of this situation and do what is best. If some code of laws, which regulate and protect the ships of our rivals, is found to be more advantageous than the code our vessels have been working under, then do not let us hesitate to adopt them, be they English, French, Scandinavian or Hottentot.

Foreign Trade Vital to Commercial Future of United States

That the commercial future of the United States depends upon a development of a permanent export market, and that the wartime foreign trade of this country was artificial and is being rapidly lost, were points brought out strikingly in an informal talk given at the United States Shipping Board to a body of newspaper representatives by R. T. Merrill, of the staff of Vice-President J. B. Smull, of the Emergency Fleet Corporation. His subject was but one of a number of studies which the board is having made of the basic facts affecting and underlying world trade conditions and especially the economic position of the United States.

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Shipping Board Ready to Operate Under Jones Act

Chairman Lasker and Board Handling Shipping Policies, While J. W. Powell, Surrounded by Competent Shipping Men, Directs Operation

WHEN Charles Piez, former director general of the Emergency Fleet Corporation, called at the Shipping Board on November 15, he expressed the opinion that the Shipping Board had made remarkable progress and that Mr. Lasker had applied to the Shipping Board and Emergency Fleet Corporation a scheme of organization existing in many large industries. Mr. Piez declared that the board was now in a position to put into operation the excellent provisions of the Merchant Marine Act and that Mr. Lasker had, by appointing Joseph W. Powell president of the Emergency Fleet Corporation and surrounding him with competent ship operators, placed his house in order to do business.

According to Mr. Piez the principal trouble today is the vast reduction in tonnage of ocean freights which has caused a stagnant market for ships which will not improve until there is a resumption in foreign trade. He said, "constant criticism of the Shipping Board based in many cases on absolute ignorance of the conditions is fast destroying what little hope the American people have in the successful establishment of an American Merchant Marine."

Combination Cargo and Passenger Ships in Demand

Hearings were held before the Shipping Board on November 14 relating to the allocation of the "535" and "502" foot combination passenger and cargo steamers to operators on the Pacific Coast. Representatives of the ports, the interested steamship lines, the trans-continental railroads and the various civic organizations presented arguments in favor of their respective terminals.

The ports were requested to sponsor the steamship company or companies applying for allocations and the steamship companies were asked to submit a brief history of their lines, outlining their finances, connections and personnel.

A point brought out was that any service established by the board under the Merchant Marine Act must be adequate, regular and permanent. At the present time, it was stated, it takes a "535" type of passenger-ship 70 days to make a round trip from San Francisco to the Orient. With three of these steamers in service a sailing can be made every three weeks and with five a two weeks schedule can be maintained.

Pacific Coast Requirements

The number and types of ships that were requested for allocation to Pacific steamship lines were as follows:

Five "535" combination passenger and cargo ships for Seattle.

Three "502" combination passenger and cargo ships for Portland.

Five "535" and two "502" foot combination passenger ships for San Francisco.

Three ex-German liners for tourist traffic between Los Angeles and Honolulu.

San Diego also requires passenger ships but has not stated the number.

Atlantic Coast Requirements

Frank C. Munson, president of the Munson Line, stated that he had a contract with the board, dated August 6, 1920, for five "535" foot steamers and had already received two, the *American Legion* and the *Southern Cross*. He asked that the balance be allocated to him as soon as possible as trade conditions with Brazil, Uruguay and the Argentine Republic warranted their being placed in service.

Mr. T. H. Rossbottom of the United States Lines asked for three "535" foot steamers in place of the *Princess Matoika*, the *Hudson* and the *Potomac* for the Bremen route. He also requested that the *Princess Matoika* and *Potomac* should be permanently reconditioned and substituted for the two "502" foot steamers now on the London route.

Committee to Recommend Allocations

Mr. Lasker stated that a committee consisting of Frederick I. Thompson, chairman, and Edward C. Plummer, on trade routes acting with H. S. Kimball, and A. J. Frey, vice-president of the Emergency Fleet Corporation, would investigate the financial status and stability of the companies requiring steamers and make recommendations to the board for allocations.

Conference with Railroads on Foreign Contracts

The United States Shipping Board has announced that all railroads having traffic contracts with foreign steamship lines will be invited to a conference with members of the board at Washington on December 1 to discuss the nature of the contracts and their abrogation if they are found to be detrimental to the development of an American merchant marine.

The Interstate Commerce Commission recently called upon the railroads to file with it copies of such contracts, and this was done by some 28 railroads. There has been much criticism of the contracts by certain members of Congress because in them the railroads frequently made exclusive traffic agreements and extended various privileges to foreign lines which are now regarded as prejudicial to American shipping, although most of the contracts were made many years ago at a time when there was little American shipping.

Cooperation Sought

While some of the speeches regarding these contracts have accused the railroads of alining themselves with foreign interests as against the American shipping, the members of the board, in making the announcement, were careful to refrain from criticising the roads and stated that the roads were to be "invited" to the conference and approached in a spirit of cooperation. It was recognized that the contracts were entered into before this Government had adopted a policy of building up a merchant marine, and it was stated that it was not expected there would be any difficulty in getting together with the railroads upon a plan for coordinating American ocean and rail transportation.

May Substitute Contracts with American Ships

If it is found that the contracts are detrimental to American interests, an effort will be made to substitute contracts with American ships. The Shipping Board will be represented at the conference by Commissioners Thompson, Plummer and Lissner, who are members of the joint committee on interstate commerce and railroad relations, of which members of the Interstate Commerce Commission are also members. Commissioner Thompson proposes to consult with Chairman McChord of the Interstate Commerce Commission and the members of the commission will be invited to attend the conference if they desire. Chairman Lasker, of the Shipping Board, has conferred on the subject with the President.

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Developments in Marine Insurance

Hague Rules—Transshipment Premiums—Open Hatches—Temporary Ship Repairs—Salvage Association—Hull Provisions Consistent — Lighterage Clause — Shipboard Fires

By "Bordereaux"

NO other subject has excited so much discussion among marine underwriters during the past month as the advisability of adopting in this country the Hague Rules, 1921, recently formulated by the International Law Association at its Hague meeting. Advocates of the Rules claim them to be little more than a codification of the Harter Act, with the following three major concessions to the cargo interests, for which the latter have been unsuccessfully contending for years:

(1) The carriers are denied the right to limit their responsibility for loss or damage at a lower figure than £100 per package, as against the old customary limit of $100 or less.

(2) The carriers are forced to allow cargo owners twelve months within which to make claims and to bring suits for damage.

(3) The burden of proof, in the matter of theft and pilferage, has been shifted from the cargo owner to the carrier.

It is stated, in explanation of Article VI, to which many cargo underwriters have taken exception, that the attitude of the foreign owners with respect to carriers being allowed freedom of contract as to the terms upon which they shall hold goods before they are loaded and after they are discharged is that before they load cargo and after they discharge it their duties do not differ from those of ordinary warehousemen with whom, in many parts of the world, they are in actual competition; they therefore wish to reserve to themselves such rights as are allowed to other warehousemen.

American marine underwriters, as a rule, do not take kindly to the Hague Rules. They dislike them because they are voluntary, for one thing, and chiefly because it is felt that they give the carriers the best of the case in most of the important particulars. An international bill of lading would be welcomed by them, but the Hague proposals appear to them to offer fewer advantages than the Harter Act, if the latter were properly amended. The proposed condition that neither the carrier nor the ship shall be liable for loss or damage arising or resulting from unseaworthiness, unless caused by want of due diligence on the carriers' part to make the ship seaworthy, is regarded as ingenious and reflects the determination of the carrier to relieve himself and his ship from liability, whereas heretofore the ship has been exempted but not the carrier. It is claimed that the shipper is being asked to waive one of his few remaining defenses, in the matter of unseaworthiness and its warranty; it is practically impossible for the shipper to do as suggested and prove that the carrier did not exercise due diligence. The shipper and underwriter have had no voice in framing the ocean contract and the result is that the latter is a distinctly one-sided document. Obscurity as to just how the Rules apply in vital particulars is also charged against them. One of the foremost marine insurance authorities in this country advises the writer that you can "drive a coach and four through them."

Additional Premium for Transshipments

AS the result of a collision, a week or so ago, cargo had to be transshipped from one steamer of a well-known line to another vessel inferior in many particulars, and the question was again raised as to whether the underwriter was entitled to additional premium in consequence. Where due to the happening of an insured peril the cargo is transshipped to another vessel for the purpose of completing the insured voyage, the underwriter must accept as one of the results of the accident the burden of covering the risk on the poorer substituted steamer. The situation would be different, if the accident were not due to an insured peril; in that case the underwriters would be entitled to additional premium. The point was well illustrated, several months ago, when the *Honolulu* returned to port and transshipped her cargo because of defective stowage. This was not a peril insured against and the underwriters were adjudged entitled to additional premium both for the transshipment and for the substitution of an inferior vessel.

Damage from Open Hatches

THE act of opening and closing the hatches of a ship relates primarily to the custody of the cargo, and is therefore not an act of management of the vessel, is the interesting decision handed down recently in the case of the Andean Trading Company vs. Pacific Navigation Company, 263 Federal Reporter 559. It means that under the Harter Act the owners of the vessel are not freed from liability for damage done to cargo due to the opening and closing of hatches. One of the chief objections of underwriters to the present Harter Act is the fine distinction it draws between what constitutes care and custody of cargo, as distinguished from acts of management of the vessel.

Temporary Ship Repairs

NOW and again the question arises as to the wisdom of permitting insurance companies to be charged for temporary repairs effected for the purpose of avoiding or minimizing delay and in order that a vessel may be kept in freight-earning condition. By way of elucidation it might be added that temporary repairs necessitated by the action of a peril insured against, for which an underwriter may be held liable, are classifiable as follows:

(a) Those prudently effected at a port of refuge because the cost of permanent repairs would be excessive.

(b) Those effected at a port of refuge because of lack of the necessary facilities for the permanent repair work required.

(c) Those made at the port of destination for the same reason as (b), or in order that the vessel may proceed to another port where the damage can be repaired at a less cost.

(d) Those incurred at a port of refuge for the common safety of ship and cargo or the completion of the venture.

(e) In addition to the foregoing there are those repairs which are made by the shipowner with the object of minimizing or eliminating loss of time and these, of course, are of no benefit to the underwriter.

As it would be advantageous to the underwriter that temporary repairs be made in instances (a), (b) and (c), it has been regarded as proper that he sustain the expense so incurred, as well as the cost of permanent repairs later on. Furthermore it should be remembered that where a vessel has been damaged, by a peril insured against, the underwriter has to stand his proportion of the cost of the "particular average" repairs; but he is not liable for the freight loss

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which the shipowner suffers on account of the repair work.

But there is a rule of the Association of Average Adjusters of the United States which applies right here. It reads as follows: "The cost of reasonable temporary repairs shall be allowed . . . when the material or parts necessary for permanent repairs are unobtainable at the port where the vessel is, except after unreasonable delay." Also this: "The adjuster shall insert a note in the average statement in explanation of the allowances made."

From this it will be seen that in all cases involving delay in making repairs the liability of the underwriter turns, under adjustments in this country, on the ground of whether an unreasonable delay is incurred in effecting the repairs. Just what constitutes an "unreasonable delay" is not so easy to determine. It must be shown that the time so employed has been unusual and extraordinary as respects the specific repairs under consideration. Information as to the nature of the delay will generally be found in the note in the average statement.

Salvage Association Organized

SYNDICATE "A," of the American Marine Insurance Syndicates, has been withdrawn and in its place there is now being operated the United States Salvage Association, Incorporated, which takes over the business and organization of the former. The entire capital stock of the Salvage Association is held by the subscribers of Syndicate "A." It is a non-profit making body and its purpose is to supply the American shipping trade with a service which shall be the counterpart of that furnished by the Salvage Association of London to British shipping interests. Its agents will be placed in all parts of the world; in fact, through its arrangement with Syndicate "A" it already finds itself equipped with expert representatives at many important ports. It also starts out with "A" 's established offices at Boston, Philadelphia, Baltimore, Norfolk, Savannah, New Orleans, Galveston and San Francisco, with chief headquarters at New York. W. C. Foley heads the surveying staff, with J. A. Wilson as deputy chief surveyor. At the organization meeting the officers were chosen as follows: President, Benjamin Rush; vice-president, Walter Wood Parsons; secretary, Gomer H. Rees; and general manager, Charles R. Page.

Hull Provisions Consistent

OCCASIONALLY some one will start a discussion of the alleged inconsistency in American standard hull policies with regard to those institute clauses that prohibit a vessel from using certain ports or from carrying certain classes of cargo during the currency of the policy and then to hold the assured covered at an additional premium for any violation of this warranty. The annual rate is based on the provisions of the institute clause and owners are held to be governed by the terms of the warranty in the matter of the trades in which they employ their vessels. The secondary clause, to which exception is sometimes taken on the ground of inconsistency, will, for an additional premium, protect the owner of the vessel should the master commit an unauthorized breach of the warranties.

London's New Lighterage Clause

THE Pilferage Committee of the London Chamber of Commerce is in receipt of the terms of a new lighterage clause that is to be operative on January 1. The Association of Master Lightermen and Barge Owners is responsible for the measure. The present clause, which exonerates the carriers from all liability for damage to or loss of goods "howsoever, whensoever, or wheresoever" such damage or loss might be caused, has been the subject of discussion for several months on the part of lightermen, barge owners, merchants and shipping managers in the hope that some modification might be effected in it; and this has at last been secured. Under the provisions of the new clause goods shall be carried only at owners' or customers' risks, "excepting loss arising from pilferage and theft of goods on board the barge whilst in the course of transit—such loss or damage being limited to £50 per ton." The significant point in this new arrangement is the belief that an assumption of financial liability for safe custody best assures due care in the carriage of goods. On January 1 next the British Merchant Shipping Act, 1921, becomes effective. This has the effect of extending to lightermen and barge owners certain privileges respecting the limitation of liabilities for risks incurred in navigation which, at present, are enjoyed by shipowners.

A Round-the-World Risk

CARGO coverage has been recently effected on the exhibits to be carried by the steamer *St. Louis* on her projected round-the-world voyage. The vessel is now undergoing alterations to fit her for the cruise which will consume eleven months and will carry her to all the principal countries of the world. American exporters are highly enthusiastic over the undertaking. The cover is for about $3,000,000, against all risks on all the exhibits abroad, and is offered on a monthly value-reducing basis. The rate will probably be in the neighborhood of 3 percent.

Shipboard Fires

BOTH underwriters and shipowners are very properly exercised over the the relentless run of serious fires on ships—not quite so numerous this year as last but enough for alarm. Inferior coal and carelessness in bunkering, the latter menace having especially to do with neglect in clearing out the pockets of coal dust in the nearly-emptied bins, are charged with the majority of these disasters. In order to get at the root of the trouble an enquiry was recently undertaken by the London Board of Trade, Lloyds and the Liverpool Underwriters' Association and they have issued a statement, as a result of this investigation, giving details of fire casualties. This document leaves the causes of such fires in doubt but it contains conclusions and recommendations that should go far toward materially reducing this source of loss.

It was found that coal left in bunkers is subject to spontaneous combustion from overheating. Bunkers should be tight in order to prevent air from passing through the coal and thus providing oxygen whose absorption is attended with overheating. Coal left in bunkers should be moved to where it can be used first. Small coal is more liable to spontaneous combustion than large coal. No conclusion was drawn as regards duration of coal storage. Carelessness was found to have caused many shipboard fires, as when a worker drops his lighted match or live tobacco among inflammable goods. Most of the fires occur while the vessel is in port, loading or unloading. Oil-driven vessels contribute numerous fires, resultant from accidental upset or leakage, and the vessel is often totally destroyed as a consequence of difficulty in controlling such casualties. Short circuits of electric wires add their quota, the sparks falling on combustible substances.

Great care should be taken in observing the condition in which certain commodities, subject to spontaneous combustion, are shipped, as well as how they are bagged and stored; among such dangerous merchandise was listed the following: Copra, sugar in bags, cotton, cottonseed, oil cake, coir, nitrate, hemp and jute, old rope, rags and flax waste, sheep skins and fish guano. Water coming in contact with calcium carbide or phosphorus caused several serious blazes. In a word, the chemical forces of nature plus human elements, such as carelessness, have been at the bottom of the great majority of fires on ships. Workmen should be impressed with a proper sense of their responsibility, and ship property will greatly benefit thereby.

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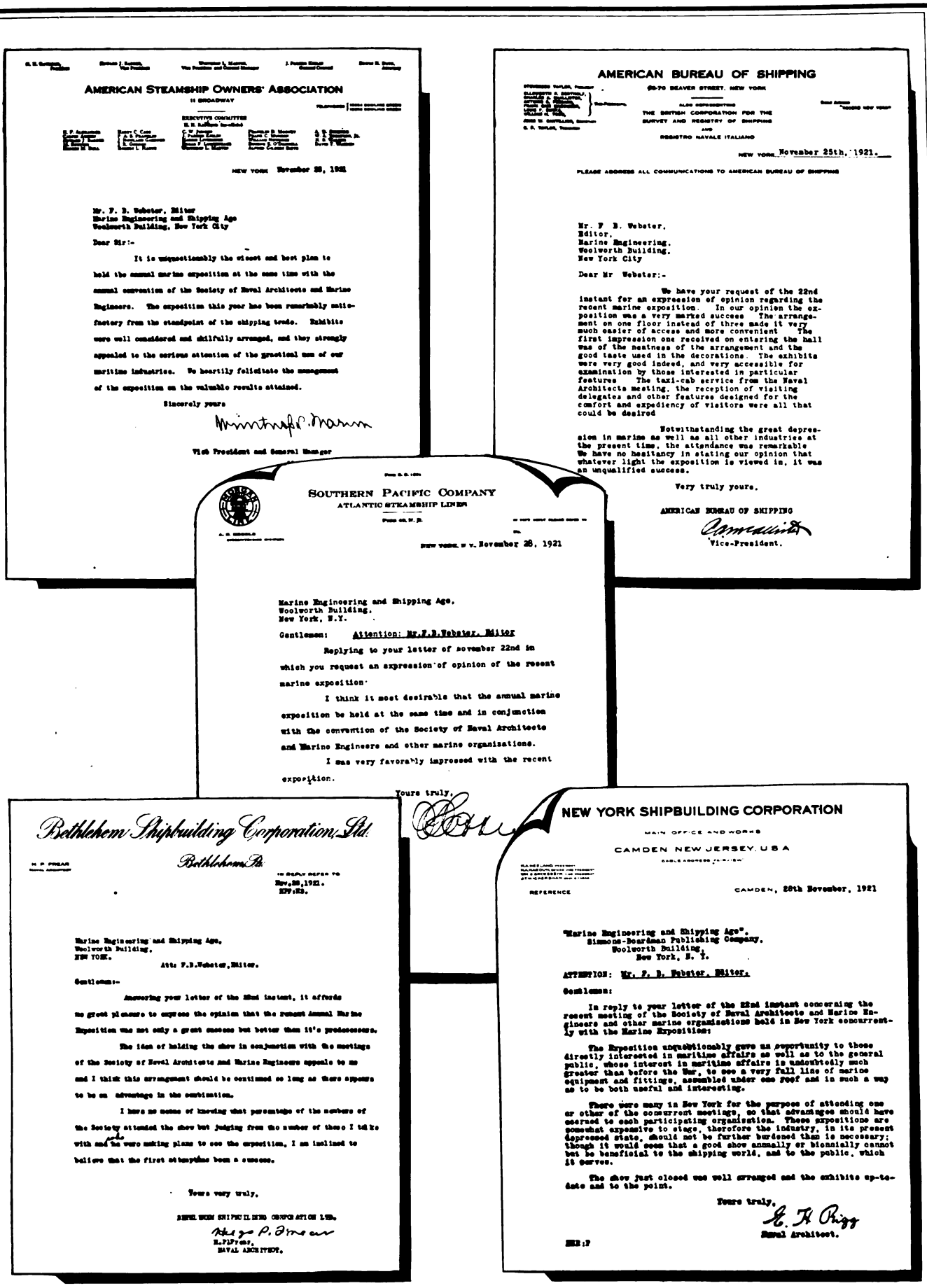

AMERICAN STEAMSHIP OWNERS' ASSOCIATION
11 BROADWAY

EXECUTIVE COMMITTEE

NEW YORK November 28, 1921

Mr. F. B. Webster, Editor
Marine Engineering and Shipping Age
Woolworth Building, New York City

Dear Sir:-

It is unquestionably the wisest and best plan to hold the annual marine exposition at the same time with the annual convention of the Society of Naval Architects and Marine Engineers. The exposition this year has been remarkably satisfactory from the standpoint of the shipping trade. Exhibits were well considered and skilfully arranged, and they strongly appealed to the serious attention of the greatest men of our maritime industries. We heartily felicitate the management of the exposition on the valuable results attained.

Sincerely yours

Vice President and General Manager

AMERICAN BUREAU OF SHIPPING
65-70 BEAVER STREET, NEW YORK

THE BRITISH CORPORATION FOR THE SURVEY AND REGISTRY OF SHIPPING
AND
REGISTRO NAVALE ITALIANO

NEW YORK November 25th, 1921.

PLEASE ADDRESS ALL COMMUNICATIONS TO AMERICAN BUREAU OF SHIPPING

Mr. F B. Webster,
Editor,
Marine Engineering,
Woolworth Building,
New York City

Dear Mr Webster:-

We have your request of the 22nd instant for an expression of opinion regarding the recent marine exposition. In our opinion the exposition was a very marked success. The arrangement on one floor instead of three made it very much easier of access and more convenient. The first impression one received on entering the hall was of the neatness of the arrangement and the good taste used in the decorations. The exhibits were very good indeed, and very accessible for examination by those interested in particular features. The taxi-cab service from the Naval Architects meeting, the reception of visiting delegates and other features designed for the comfort and expediency of visitors were all that could be desired.

Notwithstanding the great depression in marine as well as all other industries at the present time, the attendance was remarkable. We have no hesitancy in stating our opinion that whatever light the exposition is viewed in, it was an unqualified success.

Very truly yours,

AMERICAN BUREAU OF SHIPPING

Vice-President.

SOUTHERN PACIFIC COMPANY
ATLANTIC STEAMSHIP LINES

NEW YORK, N. Y. November 26, 1921

Marine Engineering and Shipping Age,
Woolworth Building,
New York, N.Y.

Gentlemen: Attention: Mr.F.B.Webster, Editor

Replying to your letter of November 22nd in which you request an expression of opinion of the recent marine exposition.

I think it most desirable that the annual marine exposition be held at the same time and in conjunction with the convention of the Society of Naval Architects and Marine Engineers and other marine organizations.

I was very favorably impressed with the recent exposition.

Yours truly,

Bethlehem Shipbuilding Corporation, Ltd.

Bethlehem Pa.

IN REPLY REFER TO
Nov.28,1921.
HPF:HB.

Marine Engineering and Shipping Age,
Woolworth Building,
NEW YORK.

Attn: F.B.Webster,Editor.

Gentlemen:-

Answering your letter of the 22nd instant, it affords me great pleasure to express the opinion that the recent Annual Marine Exposition was not only a great success but better than it's predecessors.

The idea of holding the show in conjunction with the meetings of the Society of Naval Architects and Marine Engineers appeals to me and I think this arrangement should be continued so long as there appears to be an advantage in the combination.

I have no means of knowing what percentage of the members of the Society attended the show but judging from the number of them I talked with and who were making plans to see the exposition, I am inclined to believe that the first attempt has been a success.

Yours very truly,

BETHLEHEM SHIPBUILDING CORPORATION LTD.

H.F.Freer,
NAVAL ARCHITECT.

NEW YORK SHIPBUILDING CORPORATION
MAIN OFFICE AND WORKS
CAMDEN NEW JERSEY, U.S.A.

REFERENCE

CAMDEN, 28th November, 1921

"Marine Engineering and Shipping Age".
Simmons-Boardman Publishing Company,
Woolworth Building,
New York, N. Y.

ATTENTION: Mr. F. B. Webster, Editor.

Gentlemen:

In reply to your letter of the 22nd instant concerning the recent meeting of the Society of Naval Architects and Marine Engineers and other marine organizations held in New York concurrently with the Marine Exposition:

The Exposition unquestionably gave an opportunity to those directly interested in maritime affairs as well as to the general public, whose interest in maritime affairs is undoubtedly much greater than before the War, to see a very full line of marine equipment and fittings, assembled under one roof and in such a way as to be both useful and interesting.

There were many in New York for the purpose of attending one or other of the concurrent meetings, so that advantages should have accrued to each participating organization. These expositions are somewhat expensive to stage, therefore the industry, in its present depressed state, should not be further burdened than is necessary; though it would seem that a good show annually or biennially cannot but be beneficial to the shipping world, and to the public, which it serves.

The show just closed was well arranged and the exhibits up-to-date and to the point.

Yours truly,

E. H. Rigg
Naval Architect.

EHR:P

Shipping and Shipbuilding Executives Endorse Marine Exposition

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American Marine Week an Unqualified Success

Marine Exposition the Leading New York Attraction During the Week of November 14-19—Conventions and Committee Meetings of Marine Associations Attract Large Gathering of Shipping Men

WHEN President Warren G. Harding pressed a telegraph key at the White House on November 14 which was the signal for the official opening of the Marine Exposition, he started the first cooperative Shipping and Shipbuilding Show that has ever been staged in this country. As it is known that it is the earnest desire of the President that our merchant marine shall be established on a firm basis during his administration, it is with pleasure that we are able to state that the combined efforts of the principal marine associations to make American Marine Week a real factor in the development of our shipping has met with unqualified success.

The exposition opened at 2 P. M. on Monday, November 14, with nearly all the exhibits in place. The booths throughout were tastefully arranged and decorated, as shown in the accompanying illustrations. In the evening the Robins Dry Dock Marine Band gave a concert and Senator W. M. Calder of New York delivered an address on the American merchant marine.

Senator Calder's Speech

Senator Calder said, in part: "Since my entry into Congress, I have, with other members from this State, urged a policy of Government assistance to passenger and freight vessels operated by Americans in foreign trade. Had we adopted such a policy twenty-five years ago, we would have had a merchant fleet instead of attempting to construct one in the excitement and at the prices produced by the war.

"For many months, Congress labored with the Merchant Marine Act of 1920. The result was enacted in a law now known as the Jones Law. It is generally sound and it is an effective piece of legislation. I know of no legitimate reason, that has as yet been advanced, that would justify us in changing it.

"The Jones Law prescribes trade routes. These services should be administered by great corporations whose stock is widely held. Our people inland must be made to become stockholders in our maritime enterprises. Private ownership of American shipping is specifically prescribed by the law.

"England can operate vessels for one-half the cost to us. Her crews receive 50 percent of the wages paid to our crews. Her supplies cost less. Her construction cost is but 60 percent of ours. Other maritime nations present an even more helpless case. We cannot successfully compete with other maritime nations of the world without government aid.

"It is essential to have a merchant marine for both defensive and commercial reasons. We have probably five million tons of commercially effective shipping. We have in the Jones Law the basis for a sound shipping policy. Our people are interested and have clearly shown that they want a merchant marine. What then are we to do?

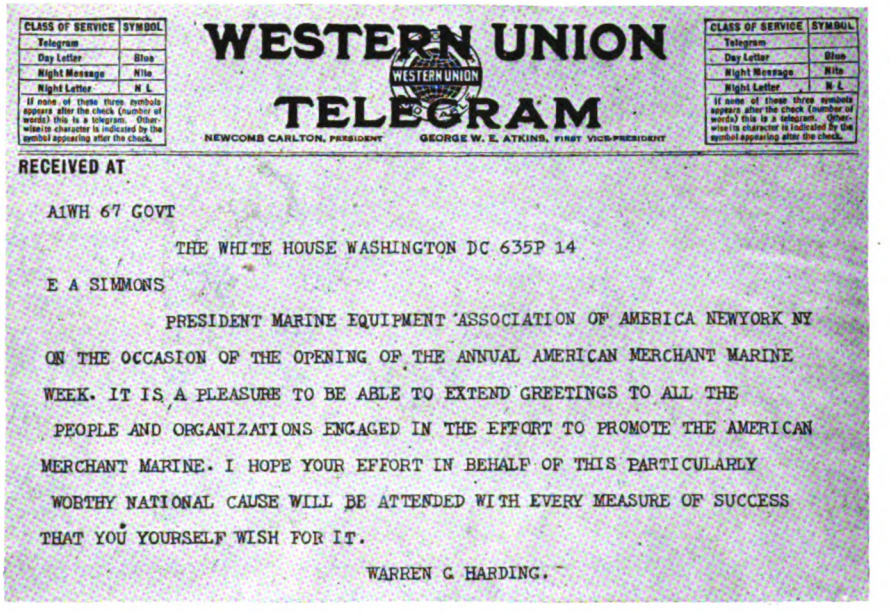
Cooperation of Marine Association Urged

"In the first place, organizations such as the Society of Naval Architects and Marine Engineers, the American Steamship Owners' Association, and others of similar nature should be able to crystallize their ideas into definite form failing to seek personal advantage for any one or any group in a desire to benefit the general proposition. These ideas, commonly agreed upon should be spread broadcast. Educate the public, Educate your Congressmen. But stick to one essential doctrine.

"In the second place, the Shipping Board must and shall take the Jones Law as their Magna Charta. They shall enforce it section for section, paragraph for paragraph, line for line, word for word.

"The better vessels, comprising about one-half of the fleet, should be disposed of as speedily as possible to American companies to be operated under our flag, and the price and terms should be made with a view to their continued operation.

"Third is the duty of Congress. We have done much. We are prepared to do more. We know that there is only one way to build a national merchant marine and that way is to make it commercially profitable. I have no doubt of the probable passing of any measure having that with an object provided it is based upon sound reason. We are entitled to carry at least half of our own commerce both out and in. I believe that other nations of the world would gladly consent to this. I believe Congress will do anything necessary to attain such an objective."



WESTERN UNION TELEGRAM

NEWCOMB CARLTON, PRESIDENT — GEORGE W. E. ATKINS, FIRST VICE-PRESIDENT

RECEIVED AT

A1WH 67 GOVT

THE WHITE HOUSE WASHINGTON DC 635P 14

E A SIMMONS

PRESIDENT MARINE EQUIPMENT ASSOCIATION OF AMERICA NEWYORK NY

ON THE OCCASION OF THE OPENING OF THE ANNUAL AMERICAN MERCHANT MARINE WEEK. IT IS A PLEASURE TO BE ABLE TO EXTEND GREETINGS TO ALL THE PEOPLE AND ORGANIZATIONS ENGAGED IN THE EFFORT TO PROMOTE THE AMERICAN MERCHANT MARINE. I HOPE YOUR EFFORT IN BEHALF OF THIS PARTICULARLY WORTHY NATIONAL CAUSE WILL BE ATTENDED WITH EVERY MEASURE OF SUCCESS THAT YOU YOURSELF WISH FOR IT.

WARREN G HARDING.

Telegram Sent by President Harding at the Opening of the Marine Exposition

Navy Night

On Tuesday evening, Navy Night, the features were an address by Captain R. D. White, U. S. N., inspector of navigational material, stationed at the Sperry Gryoscope Company, Brooklyn, N. Y., and a band concert by the Brooklyn Navy Yard Band of 20 pieces, under the leadership of Alex Morris.

Captain White addressed a large audience at 8:30 P. M.

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speaking chiefly on the Navy and giving a few of his views on the proposed international disarmament conference. Captain White stated that it was a question of removing the causes of war and eliminating the friction between nations. He characterized the disarmament conference as one of international justice rather than a court of arbitration. He appealed for a big American merchant marine with a carrying power sufficient to take the greater part of our commerce.

ANNUAL MEETING OF THE MARINE EQUIPMENT ASSOCIATION

The annual meeting of the Marine Equipment Association of America was held in the auditorium on the exposition floor at 11 o'clock Wednesday morning. President E. A. Simmons presided. The minutes of the March 28 meeting of the association were read and approved.

President Simmons then outlined the activities of the Executive Committee, officers and members of the various subcommittees since the March 28 meeting. He especially emphasized the work of the Exhibit Committee, to which he attributed the success of the exhibition. He further pointed out the possibilities that lie before the association in its determination to function in the marine fields as a Chamber of Commerce and in making "American Marine Week" a national feature in the events of the country.

In order that the name of the association may more correctly indicate its membership and the character of the work it proposes to do it was recommended that the name be changed to Marine Association of America. Action will be taken by the Executive Committee at its next meeting—December 12.

Preliminary figures submitted by the treasurer showed conclusively that the receipts would exceed the expenditures; but a definite statement was not possible because of the uncertainty of income from paid admissions and concessions during the show and certain incidental expenses.

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Col. E. A. Simmons, President, Marine Equipment Association

Col. Edward A. Simmons, of MARINE ENGINEERING AND SHIPPING AGE, was re-elected president, while W. M. Wampler, of the Elcon Company, was elected vice-president. The Nominating Committee recommended to the Executive Committee that H. C. Davis, of Row & Davis, Engineers, Inc., be reappointed treasurer and Robert B. Lea, of the Sperry Gyroscope Company, secretary to succeed K. L. Ames, Jr., of the American Steel Foundries, resigned.

The following were chosen members of the Executive Committee to succeed those whose terms expire at the end of this year: First district (New England states), Albert C. Ashton, Ashton Valve Company, Boston, Mass., and E. S. Sanderson, Scoville Manufacturing Company, Waterbury, Conn.; second district (New York and New Jersey), Gardner Cornett, Pneumercator Company, New York City; third district (Pennsylvania, Maryland, Delaware, District of Columbia, Virginia and West Virginia), W. P. Smith, William Cramp & Sons Ship & Engine Building Company; fifth district (states contiguous to the Great Lakes and the Middle West), Benjamin Neilds, Jr., National Malleable Castings Company (Cleveland), New York City; and sixth district (Pacific Coast), K. W. Heinrich, Bethlehem Shipbuilding Corporation, Ltd. (California yards), Bethlehem, Pa.

EVENTS OF STEAMSHIP OWNERS' DAY

The technical committee of the American Steamship Owners' Association inspected the exhibits at the Marine Exposition Wednesday afternoon. After spending two hours and a half examining the latest types of marine equipment, they unanimously agreed that this year's exposition was a credit to the industry.

In the evening Mr. Winthrop L. Marvin, vice-president and general manager of the American Steamship Owners' Association, delivered an address at the exposition on the merchant marine. "This is the best marine exposition that I have ever seen," said Mr. Marvin in acknowledging his introduction by Colonel E. A. Simmons, president of the Marine Equipment Association. Taking up the problem of the merchant marine, Mr. Marvin said, in part:

"The problem of the American merchant marine is not merely a problem of the Shipping Board. On the contrary, out of our whole merchant shipping, on lake, river and ocean, the Shipping Board owns 8,000,000 out of about 19,000,000 tons gross register.

Congress by an overwhelming majority in the Jones law has proclaimed that Shipping Board vessels must be transferred to private ownership 'as soon as practicable.' Therefore, the question of the permanent development of our merchant shipping is a question of the development of an American industry like any other great industry, owned by private capital and directed by private enterprise, but of vital concern to the whole people of the United States.

"American shipowners began two years ago to prepare for the ending of the highly speculative era in the shipping business which had begun with the outbreak of the European war. First, overhead costs were vigorously retrenched. Salaries and wages of the staffs on shore were reduced from top to bottom. Space was economized. Rentals were cut down. Every possible effort was made to enforce efficiency and at the same time to achieve lowered costs of operation. Finally, starting in the spring of this year, last of all, there was brought about a substantial reduction of the war-time pay of seagoing officers and men.

"American shipowners foresaw the coming of this time of shrinking trade and intensified competition and manfully prepared to meet it. They were not taken by surprise. In February, 1920, they were denounced for asking the Government to sell its war-built steamers for $100 per deadweight ton. But the Government refused and set a price of $165 and upward. Now these same ships could not be sold for $50, so low have freights and prices fallen throughout the world.

"It is in a time of extreme difficulty and depression that the American people are now confronted with the need of an enduring solution of the problem of the merchant marine. But American shipowners, men of experience and courage, believe that the question can be solved by vigor, economy and aggressiveness on their part, united to a reasonable policy of cooperation from their Government. They say: 'Revise the navigation laws—but do not depend upon that alone to accomplish everything, for it will not; protect and aid shipping as manufacturing and agriculture have been aided and protected—this also must be done. Ocean ship-

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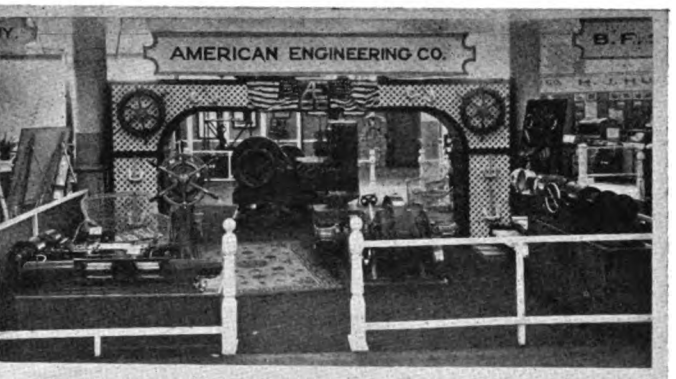
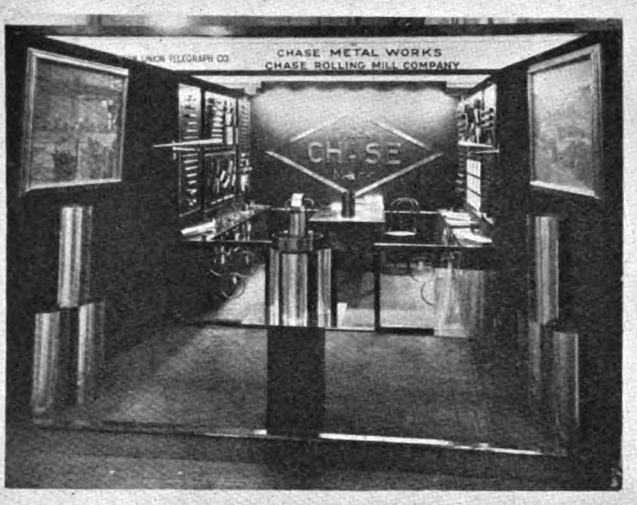
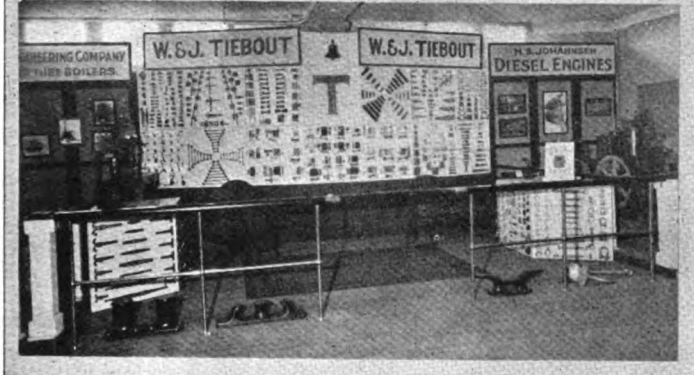
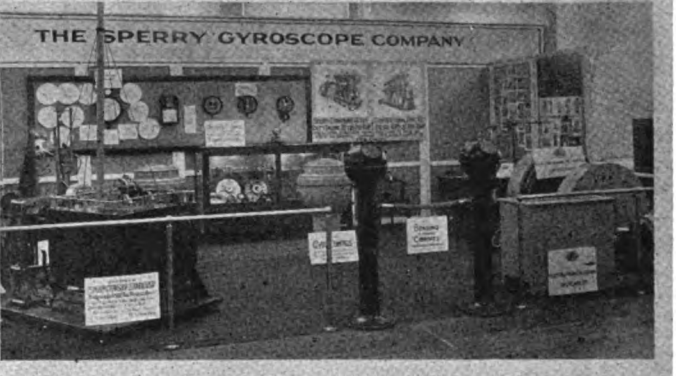
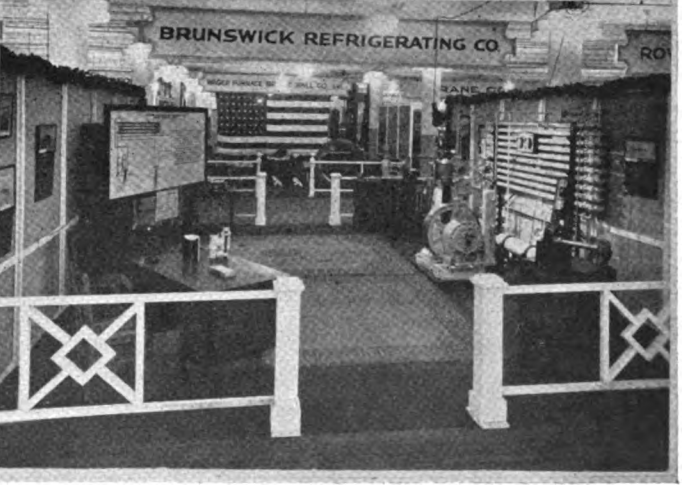
Views of Exhibits at the Marine Exposition











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ping is the most intensely competitive of industries. There is more need of National aid there, and more justification for it, than anywhere else. Enforce all that is sound and effective in the Jones law.' "

THURSDAY, NAVAL ARCHITECTS DAY

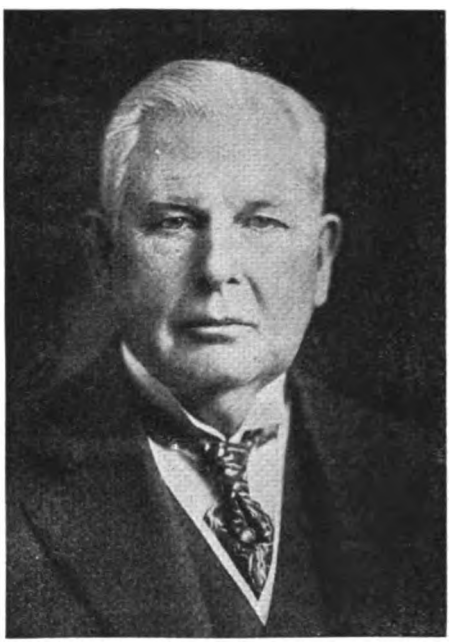
The annual convention of the Society of Naval Architects and Marine Engineers was opened in the Engineering Societies building, 29 West 39th street, New York, Thursday morning at 10 A. M., with Rear-Admiral Washington L. Capps, U. S. N., president of the society, in the chair.

The proceedings are reported in full in another part of this issue.

AMERICAN BUREAU OF SHIPPING

Rear-Admiral W. L. Capps, U. S. N., president of the Society of Naval Architects and Marine Engineers, and Stevenson Taylor, president of the American Bureau of Shipping, were hosts at a combined luncheon given at the Engineers' Club, 32 West 40th street, Thursday, November 17, at one o'clock, to the members of the Council of the Society of Naval Architects and Marine Engineers and members of the technical committees of the American Bureau of Shipping. The membership of these two bodies includes many of the leading naval architects, marine engineers and shipbuilders in the United States and the luncheon gave them an opportunity to discuss informally professional matters of vital importance to the marine industry. This meeting was called in conjunction with the Marine Exposition and the convention of the Society of Naval Architects and Marine Engineers.

H. H. Raymond, President, American Steamship Owners' Association



Stevenson Taylor, President American Bureau of Shipping

Among those present at the luncheon were Rear-Admiral J. K. Robison, U. S. N., engineer-in-chief of the United States Navy; Rear-Admiral W. L. Rodgers, U. S. N., Captain Q. B. Newman, engineer-in-chief of the United States Coast Guard; Major Frank Van Vleck, superintending marine engineer of War Department, Washington, D. C.; Commodore W. E. Reynolds, commandant U. S. Coast Guard; C. A. McAllister, vice-president, American Bureau of Shipping; Charles F. Bailey, chief engineer, Newport News Shipbuilding & Dry Dock Company; Robert Warriner, chief engineer, Bethlehem Shipbuilding Corporation, Ltd.; Naval Constructor E. C. Gillette, superintendent of naval construction, United States Lighthouse Service; E. G. Tuck, chief surveyor, American Bureau of Shipping; David Arnott, deputy chief surveyor, American Bureau of Shipping; W. M. McFarland, president-elect of the Society of Naval Architects and Marine Engineers and manager, marine department, of the Babcock & Wilcox Company. H. C. Higgins, consulting engineer, New York; A. H. Hebble, superintending engineer, Southern Pacific Steamship Company; Charles Skentelbery, marine superintendent, Warren Transportation Corporation, Boston, Mass.; Thomas F. Rowland, Jr., president, Continental Iron Works, New York; James Donald, naval architect, New York; Hugo P. Frear, naval architect, Bethlehem Shipbuilding Corporation, Ltd.; Frank E. Kirby, naval architect, New York; H. A. Magoun, vice-president, New York Shipbuilding Corporation; Professor H. C. Sadler, head of department of naval architecture, University of Michigan; F. L. DuBosque, superintendent floating equipment, Pennsylvania Railroad; W. L. R. Emmet, consulting engineer, General Electric Company; Dr. W. F. Durand, Leland-Stanford University; H. L. Aldrich, New York; E. H. Rigg, naval architect, New York Shipbuilding Corporation; E. C. Bennett, general manager, Newburgh Shipyard; W. H. Todd, president, Todd Shipyards Corporation, New York; N. E. McClelland, naval architect, Montreal, Can., and N. J. Pluymert, Jr., naval architect, Standard Transportation Company, New York.

After the luncheon, those present attended the Marine Exposition and the meeting of the Society of Naval Architects.

Through the courtesy of the United States Coast Guard Service, the new electric drive cutter *Tampa* was opened for examination to members of the Society of Naval Architects and Marine Engineers and to guests of the Marine Equipment Association of America.

The *Tampa* was moored all day Thursday and Friday and Saturday morning at Pier 59 of the International Mercantile Marine Company, at the foot of West 18th Street. Many engineers availed themselves of the opportunity to see the propelling machinery of this vessel, which consists of two Babcock & Wilcox oil burning watertube boilers supplying steam at 200 pounds gage pressure and 50 to 75 degrees superheat to a Curtis turbine direct connected to an alternating current generator supplying electric power to a 2,600 horsepower synchronous motor giving a propeller speed of 130 revolutions per minute.

THURSDAY EVENING, SHIPBUILDERS NIGHT

During the evening a concert was rendered by the Tietjen & Lang Dry Dock Marine Band. The shipbuilders, naval architects and marine engineers attended the exposition in large numbers. The delegates to the American Society of Marine Designers inspected the show in a body.

FRIDAY, NAVAL ARCHITECTS DAY

Friday was indeed a busy day with the conventions of the societies of Naval Architects and Marine Engineers and the American Society of Marine Designers in session. Every shipbuilder who could possibly get away from his work was in New York Friday to attend the exposition, the conventions and the annual banquet of the naval architects.

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Views of Exhibits at the Marine Exposition

DIAMOND POWER SPECIALTY CO
SUPERHEATER
NEW PROCESS CHEMICAL COMPANY INC.
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
WORTHINGTON PUMP & MACHINERY CORPORATION
THE NATIONAL MALLEABLE CASTINGS COMPANY
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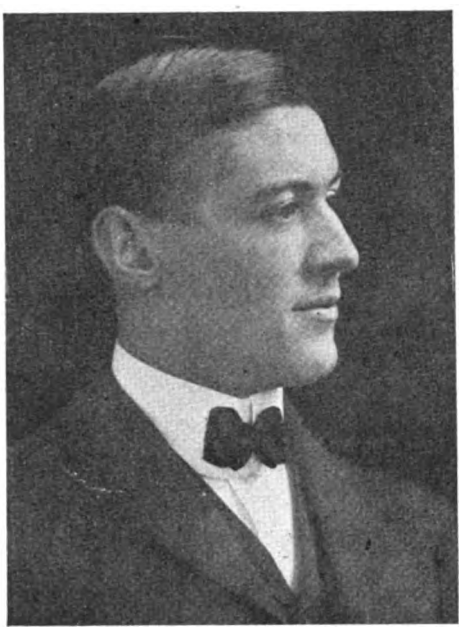
SATURDAY, MARINE DESIGNERS DAY

Through the courtesy of the Shipping Board, the *Leviathan*, America's largest passenger ship, and the *Victorious*, the latest freighter to be equipped with electric drive, were open to inspection. Tugs took the naval architects, marine engineers and guests of the Marine Association from the International Mercantile Company's pier, No. 59, to the Hoboken dock where the ships were moored. A large number of prominent men took advantage of this opportunity, which was really one of the best features of the week. To describe the *Leviathan* would require a feature article, but some idea of this giant ship may be obtained from a statement made by Mr. A. G. Rossell to the effect that it would cost the companies who are making a real estimate on reconditioning this boat between $40,000 and $50,000 each to submit their bids. The specifications for this work comprise twelve volumes in addition to two volumes of photographs.

The *Victorious*, although moored to the dock, ran a series of reversals from full speed ahead to full speed astern under the personal direction of H. B. Taylor, chief turbine engineer for the Shipping Board. The rapidity with which the motor can be brought to a stop from full speed ahead and then reversed to full speed astern through both its magnetic and manual controls was a revelation that was fully appreciated by the prominent shipping men who visited the ship during the day. The *Victorious*, re-engined by the Todd Shipyards Corporation, is a vessel of 12,000 tons deadweight with a turbo-electric installation of 3,000 shaft horsepower, furnished by the General Electric Company. The turbine and generator operate at 3,000 and the motor at 100 revolutions per minute at full speed. Steam is generated in three Scotch boilers, fitted with Foster superheaters of the firetube type, at 200 degrees superheat.



E. H. Monroe, President-Elect, American Society of Marine Designers

CONVENTION OF MARINE DESIGNERS

The tenth annual convention of the American Society of Marine Designers opened Friday, November 18, in the auditorium of the exposition, delegates from all branches of the organization being present. The convention was called to order at 10 A. M., by the president of the New York branch No. 23, Mr. W. W. Robertson, who welcomed the officers and delegates of the organization to the city and complimented them on their loyalty to the society.

Mr. C. E. Deiser, national president, responded briefly and called for delegates' credentials. The reports of all the standing and special committees were then received, which was followed by the reports of the secretaries of the various branches, all reporting a belief that there would be a change for the better in the very near future.

The election of officers resulted as follows:

President, E. H. Monroe, Washington, D. C.; vice-president, C. C. Jacobson, New York City; secretary, B. G. Barnes, Quincy, Mass.; treasurer, J. B. Sadler, Norfolk, Va.; executive committeemen, John Thomson, Bethlehem, Pa., A. H. Haag Baltimore, Md., and C. D. Anderson, Washington, D. C.

It was voted to change the name of the society from the American Society of Marine Draftsmen, as it was formerly known, to American Society of Marine Designers.

The next convention will be held under the auspices of the Delaware River Branch, at Philadelphia, Pa.

PURPOSE OF SOCIETY

The American Society of Marine Designers is an organization promulgated among technical men engaged in the marine drafting profession of the United States to promote their general welfare professionally, intellectually and socially and to cultivate the highest standard of professional ethics among them. At a convention held in Philadelphia from December 2 to 4, 1912, delegates representing fourteen ship and navy yards completed the organization of the society and elected officers consisting of William S. Haney, of William Cramp & Sons Ship & Engine Building Company, president; Sanford C. Jenkins, of the Newport News Shipbuilding & Dry Dock Company, vice-president; Sanders Van Auken, secretary and treasurer.

The executive committeemen elected were J. Emile Schmeltzer, now assistant general manager, Merchant Shipbuilding Corporation, and Perry K. Thurston, of the Navy Department, Washington, D. C.

From 1912 on the society grew in leaps and bounds and by 1914 no less than 24 branches were established in all parts of the country. During the war, new branches sprang up and swelled the membership but with the signing of the Armistice and the slackening off of work in the shipyards a number of these branches went out of existence.

The Society of Marine Designers is doing good work in a large way among the marine draftsmen and should be encouraged in every way. At the present time there are 12 branches.

PROCEEDINGS

In addition to changing the name of the society to American Society of Marine Designers, it was decided to institute an active campaign to secure positions for those of its members and ex-members who are at present out of work. Engineering firms will be furnished with a list of names of men of high calibre and character who are at present unemployed and these firms will be requested to send their inquiries for engineers to the secretary of the society.

A number of technical papers were read at the Saturday afternoon session and a banquet was given Saturday evening at the Hotel Breslin.

OUR DAILY EDITION

An outstanding feature of the show was the Daily Edition of MARINE ENGINEERING AND SHIPPING AGE. It contained condensed reports of all the principal happenings of interest during the week, the various conventions, etc., and, in addition, kept the exhibitors in daily attendance in close touch with what was transpiring in the way of new work and contracts placed in the marine field.

In this connection it is a noteworthy fact that "The Daily" placed before its readers information on all classes of marine work, such as new vessel construction and repairs and port and pier developments, having a total estimated valuation of more than $20,761,000, which goes to show that the editorial staff, while "covering" the many phases of the exposition and its incidental attractions did not lose sight of the thing closest to the heart of shipbuilders, repair and equipment men—*contracts*. MARINE ENGINEERING AND SHIPPING AGE also provides a daily report of general marine information which is broadcasted by wireless from Newark, N. J.

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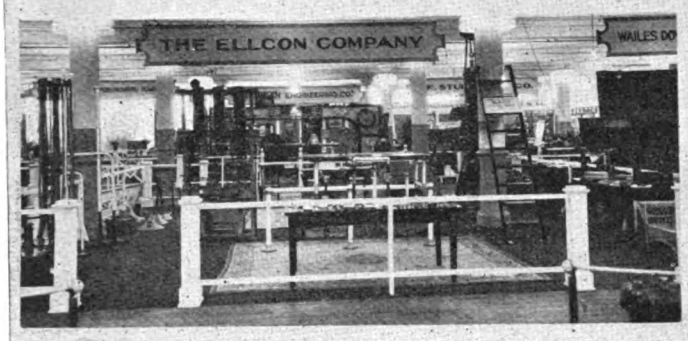
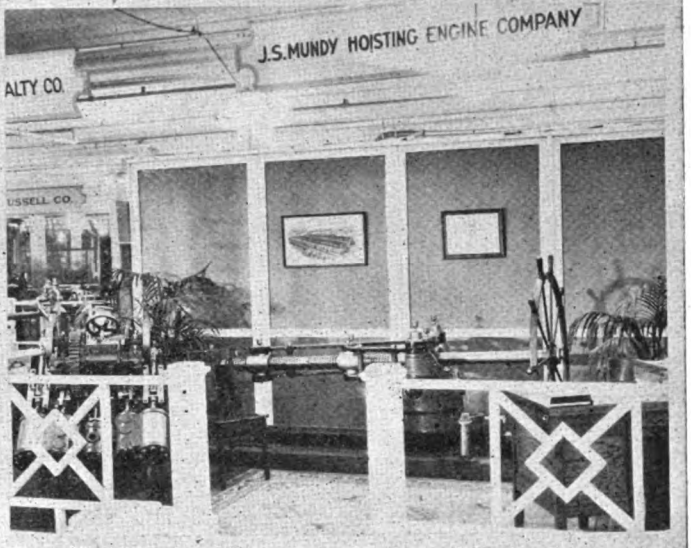
Views of Exhibits at the Marine Exposition





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New Devices Exhibited at the Marine Exposition

Small Capacity Mono-rail Hoist for Marine and Terminal Service

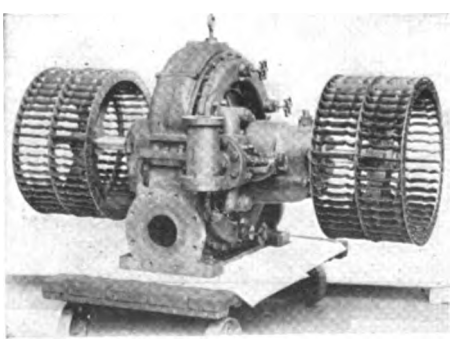
THE new ton and half-ton mono-rail hoists developed by the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., are adaptable to many uses where small controlled hoists are required for the rapid handling of materials. Probably their greatest use in the marine field is in freight handling operations at terminals, ash handling on board ship and the like, while in shipyards and manufacturing plants they are useful for moving materials in process of fabrication.

Shepard Electric "Liftabout" Handling Ashes on Board Ship

The new "Liftabout" as it is known has the Shepard type of balanced drive and an oil bath system of lubrication for gears and running parts. All mechanical and electrical units are enclosed in tight metal housings which exclude dirt, dust, fumes and dampness. These hoists are equipped with Zobell motors especially designed for hoisting service and arranged for variable or constant speed as desired. The hoisting and traversing motions are controlled from the floor by means of two operating cords attached to controlling levers.

New Special Service Blowers

AT the exhibit of the B. F. Sturtevant Company, Boston, Mass., two types of naval blower units were shown. Features of one of these, the scout cruiser type known as V D-7, are split bearing casings for ready access to the bearings and an improved speed regulating governor.



Closed Fireroom Forced Draft Blower

The second blower, known as C-12, is for use in connection with closed fire room systems of forced draft. In this machine the fan bearings are eliminated by designing the machine with overhanging fans. The shorter base with space and weight savings is also a feature of this type, in addition to the elimination of alinement troubles.

Longitudinally Trussed Dry Dock

THE model of a 5,000-ton sectional dry dock of rigid construction was shown by the Crandall Engineering Company of Boston, Mass. Rigidity and strength are obtained in this type dock by building each section as the panel of a Warren pin truss. These sections when connected, it is claimed, give a strength to the structure comparable with a solid wing wall dock. The largest dock of this type so far built is of 8,000 tons at the yard of the Bruce Dry Dock Company, Pensacola, Fla.

Rotary Pump for Heavy Liquids

A ROTARY pump consisting essentially of a double cylinder through which liquids are forced by two meshing cams was shown by the Northern Fire Apparatus Company, Minneapolis, Minn. Pilot gears are attached to the ends of the cam shafts and a rotary motion transmitted to one of the shafts operates both cams. Close contact between the cam teeth and the cylinder is provided by small blades inserted in the teeth which are held out against the cylinder walls by means of light springs.

Non-Ferrous Metals Exhibit

A DEMONSTRATION of the application of metallography to the study of brass was given during the Exposition at the booth of the Scovill Manufacturing Company of Waterbury, Conn. Samples of corroded and season cracked condenser tubes were shown which indicated the inner structure of the metal and what actually happens when condenser tubes fail in service.

The Microstructure of Brass

The accompanying illustration represents sections of various brasses which were studied under the microscope after they had been subjected to a variety of treatments.

Exit the Rivet Passer

THE Harrold rivet gun, exhibited in the booth of the American Car & Foundry Company, at the Marine Exposition, is a new device which is being used by the Federal Shipbuilding Company for passing rivets automatically instead of by hand from the rivet heater to the holder-on. The device can be attached to the rivet heating forge and operated by the rivet heater. Two riveting gangs working close together can be served by one heater. A reduction of loss of time and accidents is claimed for this device.

Safety Blocks Exhibited

TWO blocks recently developed at the Marine Decking & Supply Company's works at Easton, Pa., were shown at the Exposition. One of these includes a safety feature consisting of a fork contrivance to insure positive stop at any desired position of a load.

The second block embodies an improvement over the ordinary snatch block, obtained by fitting a pair of sister hooks in place of the customary swivel hook and link. After being

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Views of Exhibits at the Marine Exposition

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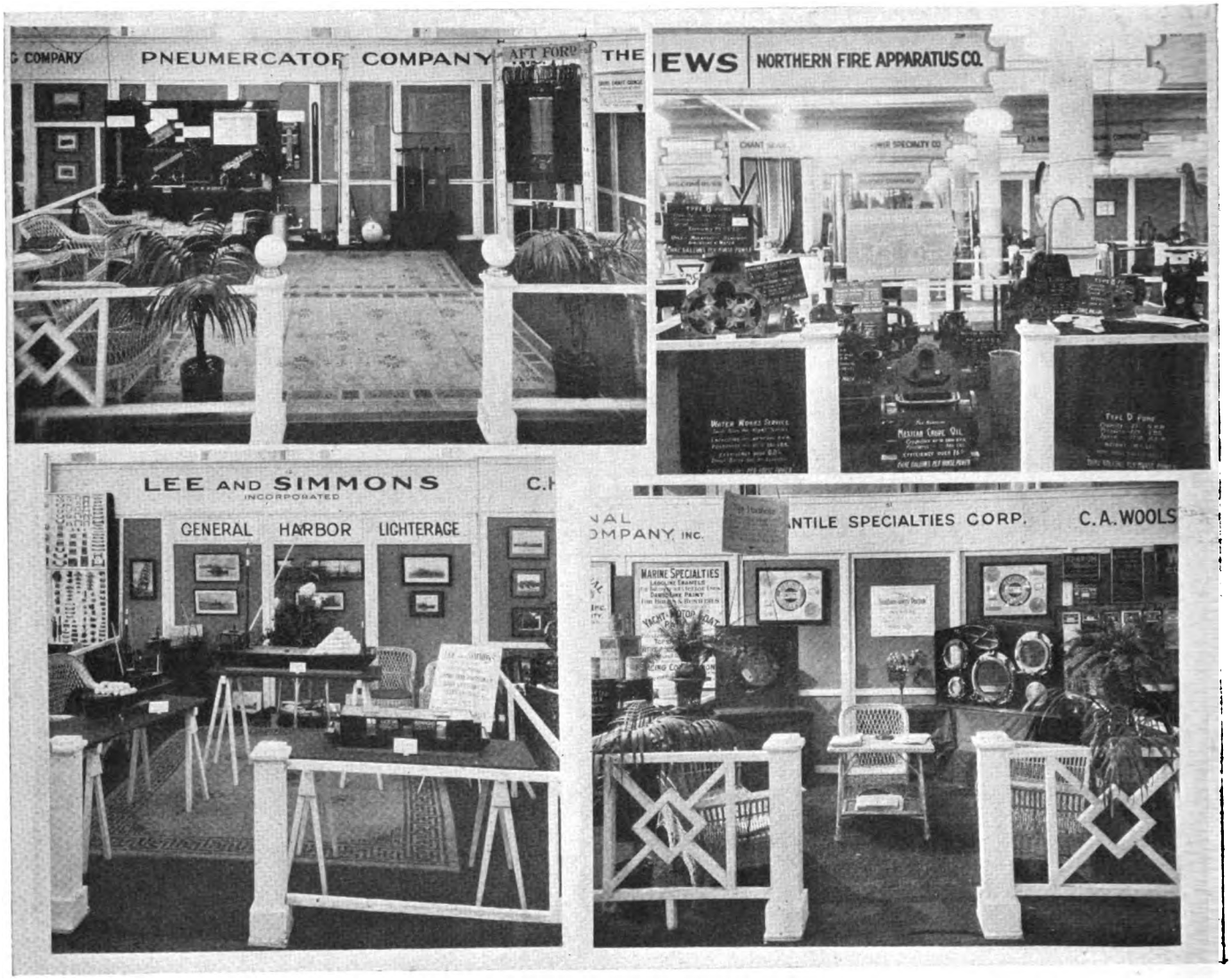

Views of Exhibits at the Marine Exposition

attached to a fall, the sister hooks are held in position by wire mousing which prevents the hook from becoming detached from the fall.

Valveless Reciprocating Pump

A NEW type valveless reciprocating pump invented by H. A. Danstrup and Joseph Harrison and developed by the Clinton Dry Docks, Brooklyn, N. Y., was shown for the first time at the booth of the Todd Shipyards Corporation.

This pump consists of a piston actuated by a crank and a set of gears at the end of the crank shaft which operates a cast steel disk, cored in such a manner as to open and close two ports in the cylinder. The pump is designed for handling any liquid, but is especially recommended for molasses or heavy oil. It is claimed that a continuous flow of liquid is insured by the constant vacuum maintained in the pump.

Marine Auxiliary Motors

TWO new motors, the C O M and the R C M types built for use with deck machinery and for below deck auxiliaries respectively, were exhibited by the General Electric Company, Schenectady, N. Y. The C O M type for deck machinery is specially constructed to withstand the severe weather conditions at sea.

The R C M motor for continuous duty with below deck auxiliaries has a special system of ventilation which permits the use of motors of maximum size and rigidity, while at the same time preventing the entrance of dripping or splashing oil, water and the like.

The C O M motor was shown at the General Electric booth while the R C M motor was connected to a centrifugal pump at the booth of the C. H. Wheeler Manufacturing Company, of Philadelphia, Pa.

Electrically Driven Auxiliaries

A PORTABLE electric winch having one drum and two "niggerheads" built for the Department of Docks, New York City, was exhibited by the American Engineering Company, Philadelphia, Pa. With a 4,000-pound load this hoist has a lifting speed of 200 feet per minute and a rapid light hook lowering speed. A dynamic brake insures immediate stopping of the hoist when the current is shut off.

Other equipment in the exhibit of this company included an electro-hydraulic reduction gear, consisting of a variable stroke, constant speed, reversible rotary pump and a rotary reciprocating hydraulic motor, oil actuated, the speed being controlled by changing the stroke of the pump from zero to a maximum; a spur gear windlass and electric gypsy, the former having a head locking arrangement and both being driven by variable speed motors; and an electro-hydraulic steering arrangement which demonstrated the complete equipment necessary for handling a vessel, including a pilot house stand, hydraulic telemotor and the steerer itself.

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Meeting of Naval Architects and Marine Engineers Feature of "American Marine Week"

Walter M. McFarland Elected President—Present Problems in Ship Construction and Operation Discussed—Rapid Return to Normal Conditions Predicted

THE annual convention of the Society of Naval Architects and Marine Engineers was opened in the Engineering Societies Building, 29 West 39th street, New York, on November 17 at 10 A. M., with Rear-Admiral Washington L. Capps, U. S. N., president of the society, in the chair.

The report of the secretary-treasurer showed that the membership as of October 31 was 1,695 as compared with 1,771 at the close of the annual meeting in 1920. However, the applications of 100 new candidates for membership were accepted at the morning session and many more were admitted during the convention. The report also showed that the financial condition of the society was very satisfactory.

Walter M. McFarland, President-Elect of Naval Architects' Society

Election of Officers

The following officers were elected for the terms specified:

President—(For the three years ending December 31, 1924)—Walter M. McFarland.

Vice-President—(For term expiring December 31, 1924)—Lewis Nixon, H. I. Cone, C. H. Peabody, J. W. Powell.

Members of Council—(For term expiring December 31, 1924)—Andrew Fletcher, J. H. Mull, C. W. Dyson, R. H. M. Robinson, W. G. Coxe, Robert Haig.

Associate Members of Council—(For term expiring December 31, 1924)—E. M. Bull, J. N. Pew, Jr.

Executive Committee — Stevenson Taylor, W. L. Capps, Andrew Fletcher, F. L. DuBosque, J. W. Powell.

Committee on Papers—F. L. DuBosque, J. Howland Gardner, H. L. Aldrich.

Secretary and Treasurer—Daniel H. Cox.

In his annual address, Rear-Admiral Washington L. Capps, U. S. N., president of the society, said, in part:

Abstract of President's Address

Twice during the past three years, the annual meeting of our society has been coincident with events which are epochal in the world's history. These events must necessarily have a profound effect upon the "promotion of the art of shipbuilding, commercial and naval," the object as stated in our constitution, for which this Society of Naval Architects and Marine Engineers was founded.

On November 11, 1918, was concluded an armistice which virtually ended a war greater in magnitude and in world significance than pre-war historians would have dared imagine.

Great as has been the industrial upheaval due to the world war, serious as may now appear the conditions which prevail in that industry which is the especial concern of the members of this society, it is hoped and believed that the return to normal conditions will be much more rapid at this time than at the conclusion of any of the other great world crisis. In view of the tremendous changes which have taken place in world shipping, ship construction and world trade during the last few years, it will be worth our while to note briefly some of the changes.

In 1914, the world's gross tonnage in vessels of 100 tons, or more, was approximately 49,000,000 tons. Of this, more than 42,000,000 tons was *steel steam* tonnage. In 1921, the gross *steel steam* tonnage alone had increased to nearly 55,000,000 tons. Of the total world ship tonnage of 49,000,000 tons in 1914, the United States had in overseas trade only 1,100,000 tons, while the gross United States *steam* tonnage engaged in overseas trade in 1921 was practically ten times the 1914 figure. Of this enormous expansion of United States ocean-going tonnage, approximately 8,000,000 tons were contributed by the Government of the United States through its authorized agency, the United States Shipping Board, and the cost of this additional tonnage, due largely to war conditions, was virtually equal to that of the entire pre-war world tonnage.

As opposed to the great increase in *overseas* tonnage, it is worthy of note that the increase in United States tonnage engaged in *domestic* trade in the 7-year period from 1914 to 1921 was comparatively insignificant, being less than 5 percent.

It is also interesting to note that the total increase in world tonnage in the 7-year period preceding and following 1914 was approximately 10,000,000 tons, the percentage increase for the 7-year period 1907-1914 being really greater than that for the 7-year period which included the war expansion.

Nor were the increases in American trade in American bottoms less significant than the increases in American overseas tonnage.

The entries and clearances of United States vessels in North American trade had increased from 26,000,000 tons in 1914 to 46,000,000 tons in 1921, while the overseas trade had increased from 1,700,000 tons in 1914 to 22,000,000 tons in 1921. The corresponding United States trade carried in *foreign* bottoms decreased from 31,000,000 tons of entries and clearances in 1914 to 25,000,000 tons in 1921, while the *overseas* entries and *clearances* of United States trade in *foreign* vessels *decreased* from 48,000,000 tons to 45,000,000 tons in the same period. We thus had, during the 7-year period, 1914 to 1921, a tremendous increase in *overseas* entries and clearances in United States vessels, with a slight decrease for foreign vessels, the net result being, of course, a very great increase in United States world trade.

In further illustration of the great change which has taken place in recent years in American steam steel tonnage, it is worthy of note that while the increase in this tonnage for the period 1907-1914 was approximately 50 percent,

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the increase for the following 7-year period was nearly 300 percent. Moreover, in 1914, the United States had less than 10 percent of the world's steel tonnage; it now has approximately 26 percent of the total.

When we note the variations in quantity of steel ship construction for the period in question, the facts are even more startling. In 1915, the total tonnage of ocean-going steel vessels of more than 1,000 tons gross register constructed in the United States was approximately 112,000 tons. In 1920, this had increased to nearly 2,900,000 tons, or more than 2,500 percent. Now, however, building programs are nearly completed and the actual merchant ship steel steam tonnage under construction, as reported by Lloyd's Register for the quarter ending September 30, 1921, is approximately 420,000 tons for the United States and 4,550,000 for the rest of the world.

As in the days of the sailing clipper ship when the American shipbuilder excelled all others and the American Merchant Marine was at the forefront in tonnage and efficiency, we may confidently look forward to a period when efficiency of design, construction and operation of the power-driven cargo and passenger vessels of the future will place the United States again among the leaders of maritime development, and it is to be hoped that the rivalry through which such results may be accomplished will be of an entirely friendly character largely as represented by passenger and cargo vessels rather than by vessels primarily designed for destructive purposes.

Development of the Three-Plane Navy, With or Without Battleships

By Mason S. Chace

ABSTRACT

THIS paper presents the question as to whether in the development of three-plane navies, including surface vessels, submarines and air forces, the battleship will maintain, or will lose, its superiority as the backbone of fighting fleets.

I have expressed the opinion that much still remains to be done in the way of developing the submarine, that aviation stands today as a new powerful arm of offense and defense which only through development and use can be made dependable; also, that the only defense against the attacks of air forces is the use of other air forces.

Attention is called to the fact that large high-explosive bombs carried by aeroplanes and dropped into the water alongside of a vessel can sink or seriously damage any naval vessel now in existence; and, that it would not seem to be practicable to construct vessels of sufficient strength to withstand the effect of such bombing. Underwater damage has been especially referred to, as damage under water affects both buoyancy and stability and is much more dangerous to the life of a ship than is damage above water. The local destructive effect of explosive bombs dropped on the deck of a ship can be sufficient to put that ship out of action. Ships with decks sufficiently well armored to withstand the plunging fire of heavy artillery will be to a great extent protected against the penetration of armored decks by bombs dropped from aeroplanes. The detailed possibilities of the use of aero-torpedoes, aeroplane gas attacks, smoke screens, etc., have not been gone into in this paper. The importance of the use of such methods of attack is evident.

In view of the fact that the battleship has about reached the practical limit in the way of further increase of its dimensions and consequently increase in its defensive strength; also, because its offensive strength can only be slightly increased by increasing the calibre of the guns of its main battery, it is considered that further important developments of the battleship are improbable, if not impossible.

The bomb carrying aeroplanes are considered as long range guns, capable of dropping various kinds of shells and depth bombs, which planes are to be transported to the zone of operation by the aeroplane carrier ships. It is concluded that the aeroplane carrier ships which transport the scouting, fighting and bombing planes will become the ships from which the naval engagements of the future will be carried on and directed.

In the present embryo stage of development of aviation for commercial purposes, as well as for use in warfare, I do not consider it possible to define its probable development and the specific uses which may be assigned to both lighter-than-air and heavier-than-air machines. I believe that in the three-plane navies of the future, it remains further to develop the submarine, which in the World War surprised us by its work and development, that the surface forces can be but little developed and that the greatest possibilities and probabilities of development are in the air forces, which air forces are to become of supreme importance.

There was no discussion of this paper.

The Tactical Relations Between Different Classes of Men-of-War and Their Embodiment in Design

By Rear Admiral W. L. Rodgers, U. S. N.

ABSTRACT

THE gist of this paper is to show the primary relations between offensive power, defensive power and time, resulting in three main types of ships of war. The destructive forces of warfare, like all other forces, need time for them to do a given amount of work. But the destructive forces of war can be overcome only by counter destructive forces. The passive elements of defense serve only to secure time for the attacking forces to do an appreciable amount of work. Passive defense alone may deny victory to the enemy, but only when it secures more time than the enemy has available to accomplish his necessary work. Passive defense never secures victory.

Upon these principles, naval architects lay down battleships to secure the very strongest combination they can design, having offensive strength as a force, with defensive strength to turn their attacking force into destructive work, and with mobility and speed (time element) to deny as much time as possible for the enemy's efforts to result in effective work. But to exercise these forces wisely we need "speed" ships to reconnoiter and direct our blow, and the same types of "speed" ships to screen and warn the main forces and gain time for them when attacked by the enemy and deny time to the enemy to attain his objectives. As against each other, these "speed" ships must have the means of attack to destroy each other and fight each other down in the pursuit of their objectives, i.e., information and security.

All the above are surface ships, the two other types, air craft and submarines, accept obvious weakness in attack to deny time to the enemy to meet their attack. Both types have permitted the natural law of gravity to be turned to their disadvantage in order to gain the advantage of surprise (time). Both are of moderate or small attacking force. The air craft seeks to deny time for the enemy's encounter attack to become effective by the speed of its approach and delivery of its attack. The reply to it is to be made chiefly by hostile aircraft, but also by gun fire from the ships attacked. In both cases, the weak air craft must itself be cautious and lose time, or run grave risk of destruction itself. For the type has sacrificed his powers of resistance.

The submarine, also weak in attack, by concealment denies the enemy the time for his counter attack. He must be reached by search, directed by listening devices and he must

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be counter attacked by submarines and by auxiliary surface craft. Both air craft and submarines promise to be very valuable in reconnoitering over wide strategic areas (information service).

Thus the reply to the new weapons of the last war is largely through the counter application of the same types, namely air craft and submarines. But when a type is repelled by the same type of the enemy's, and these new weapons appear in their proper relations on both sides, they sink to the role of auxiliaries and leave the battleship as the final arbiter of battle, because when properly supported, the battleship has the maximum of strength—both offensive strength to punish the enemy and of endurance defensive strength to make its punitive power effective before it is overcome itself.

DISCUSSION

The discussion on Admiral Rodgers' paper was limited because of the reluctance of members of the society, in view of the Conference on the Limitation of Armaments, to express opinions which might in any way adversely influence the great work now being done in Washington. Captain W. C. Watts, U. S. N., pointed out that the inclusion of torpedo offense on battleships presented obstacles such as submerged torpedo tubes and interference with the proper subdivision of the vessels by watertight bulkheads.

American Classification of American Ships

By W. A. Dobson

ABSTRACT

THE classification of vessels is a matter of national importance from the fact that in vessels built to the rules of a classification society, the enormous risk due to inferior construction is eliminated. Classification, therefore, becomes a safeguard to life and property in vessels so constructed and only hazards common to sea service remain. Life and property so safeguarded become part of the nation's assets.

The object of any society for registration of vessels is to classify them in accordance with their strength and seaworthiness, with proper regard, on the one hand, to safety of life and property and, on the other, to obtain the necessary strength and seagoing qualities without impairing the earning power of the vessel.

Before the introduction of iron as a building material and the careful investigation of the laws governing floating bodies, vessels were built from prototypes whose characteristics were carefully noted and those meeting with approval were incorporated in following designs.

With the introduction of iron, stresses on ship structures in still water and in waves were investigated and scantlings under which vessels might be constructed and classed were promulgated, based upon scientific investigation combined with experience at sea with vessels of all types. Compliance with such rules insured that the resultant vessels would have strength of structure sufficient to meet all conditions of sea service.

Turning to a purely American registration society we find that in 1862 the American Shipmasters' Association was incorporated by an Act of the Legislature of the State of New York; the incorporators being men well known in shipping and maritime insurance.

This association continued to function under the original title until November, 1898, when, by order of the Supreme Court of the State of New York, the name was changed to that of the American Bureau of Shipping.

Due to the decline of American shipping and its reaction upon shipbuilding, from before the Civil War until the beginning of the World War, the activities of the American Bureau of Shipping were largely confined to American built coastwise vessels. The policy of the Bureau, however, did not seem to find full favor with steamship owners and foreign classification societies became so active in American shipbuilding that, prior to the Shipping Board assuming control of the building facilities of this country, about 96 percent of the United States seagoing vessels were built under the rules of foreign societies.

Advance in connection with American shipping developed very rapidly during the World War and Congressional action, taken in connection with vessels owned by the United States, made it absolutely necessary that there should be an American bureau of classification recognized as the authority for the proper classification of its vessels.

The Merchant Marine Act of 1920 provides that all departments, boards, bureaus and commissions of the Government should recognize the American Bureau of Shipping as their agency so long as that bureau continues to be maintained as an organization which has no capital stock and pays no dividends.

As the result of the reorganization and aggressive policies adopted, the growth of the Bureau may be seen by the following figures:

In 1916	gross	tonnage	classed	was	228,539	tons
1917	"	"	"	"	550,285	"
1918	"	"	"	"	535,232	"
1919	"	"	"	"	3,030,962	"
1920	"	"	"	"	1,918,007	"

It should be considered the patriotic duty of American shipowners, builders and underwriters to aid and encourage the Bureau in its efforts to build up an organization which, with its affiliations, shall be second to none in the world in the service rendered in classing, surveying, appraising, underwriting and salvaging vessels owned by the shipping interests of this country.

If we are to have a prosperous growing merchant marine, we must also have an American classification society, capable of rendering aid of the best class to every phase of the shipping industry.

DISCUSSION

Doctor H. C. Sadler, professor of naval architecture, University of Michigan, in commenting on Mr. Dobson's paper, stated that frequent criticisms had been made of the rules of the American Bureau of Shipping regarding lack of simplicity as compared with the rules of other classification societies. He stated that this point has been taken up.

Hugo P. Frear, naval architect, Bethlehem Shipbuilding Corporation, Ltd., called attention to the importance of saving weight in the scantlings and stated that the members of transverse framed ships were higher stressed than the longitudinal frame of the Isherwood type of construction. He noted that this point does not substantiate the claim that transverse framed ships may be constructed as light as the longitudinal type.

THURSDAY AFTERNOON SESSION

The joint meeting of the Society of Naval Architects and Marine Engineers and the American Institute of Electrical Engineers opened at 2:30 p. m. with Mr. McClellan, president of the electrical society, in the chair.

Electric Propulsion of Ships

By W. E. Thau

This paper is published in full on page 925 of this issue.

DISCUSSION

W. L. R. Emmet, consulting engineer of the General Electric Company, outlined the trials of the U. S. S. *Maryland*,

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the latest naval vessel equipped with electric drive. He stated that he had been with the vessel for a week, during which time there was absolutely no trouble with the machinery and that newspaper reports to the contrary were without foundation.

Mr. Emmet felt that in certain respects this paper understated the practicability of electric propulsion equipment; that the system is distinctly more reliable than other forms of mechanical apparatus aboardship, since repairs can be made without the machinery necessary for turbine and reciprocating engine repairs. Other points which might be stressed in electric drive operation are its economy and savings in space and weight.

Special training is not needed for the engine room force in operating the machinery and in general the men are enthusiastic over the way an electric drive ship may be controlled. In speaking of low maintenance cost of the equipment, Mr. Emmet referred to the seven years' service of the U. S. collier *Jupiter*, which has cost practically nothing for repairs to machinery during that time.

Mr. Emmet outlined his reasons for thinking synchronous motors with their greater air gap than induction motors could be adaptable to propulsion units. If efficient turbines and auxiliaries are used, the excitation in starting synchronous motors can be accomplished with a low power consumption. Maintenance of these motors is comparatively simple since all parts and windings are accessible, due to the movable pole pieces. Simple solenoids are used for field windings and these are easily repaired.

Rear-Admiral W. L. Capps, U. S. N., Retiring President

In referring to the combination of the Diesel engine and electric units for propulsion, Mr. Emmet seemed to feel that high speed engines could be used without causing trouble from irregularity of flywheel effect.

Interchangeability of electric apparatus is also an advantage aboardship. The economy of this system was demonstrated on the trials of the *Maryland* when the ship ran at 19 knots on one generator and at 17 knots on one generator and two motors with two propellers trailing.

Another instance of this is the case of a merchant vessel designed for 22 knots which, running on one generator, made 18 knots. This speed, of course, would be the most economical for cruising. Larger gains are accomplished from pole changes at low speeds than are made at high speed.

Charles F. Bailey, engineering director, Newport News Shipbuilding & Dry Dock Company, compared the operation of turbine electric, Diesel electric, geared turbine and direct Diesel drives in single and twin screw vessels. This paper will appear later in MARINE ENGINEERING AND SHIPPING AGE as it contains numerous diagrams and tables that readers will find of value in determining the relative advantages of the different systems for special requirements.

William W. Smith, chief engineer, Federal Shipbuilding Company, discussed in detail points to which he took exception in the paper, citing results which he has obtained with various types of transmission machinery.

In referring to geared turbine drive he stated that he has found savings in steam consumption in favor of this type ranging from 4 to 8 percent and that superheat up to 200 degrees with additional savings is now being used in certain vessels having geared turbine drives. In his discussion of Diesel electric equipment Mr. Smith disagreed with the author's statements of space saved with this drive, claiming that Diesel installations occupy about the same space and weigh nearly twice as much as complete steam installations, including boilers. Cost per shaft horsepower for geared turbines using superheat is less than half that for twin screw Diesel electric propelling units, according to his records. Conditions of course would alter this statement.

In his discussion, an explanation is given of the backing and maneuvering power of compound reversing geared turbines which will develop 75 to 100 percent of the full ahead torque when required, as well as the effect of large slow speed wheels. In general, the backing power of steam driven compound geared turbines is ample for all requirements.

In referring to Diesel electric drive as compared with direct Diesel installations Mr. Smith seemed to think that the slower speeds of the latter tended towards greater reliability. Engine speeds of 250 to 350 revolutions per minute are not as conservative from the marine engineer's standpoint as 75 to 125 revolutions per minute. If high speeds are desirable because of weight and space saved, it would seem that mechanical gearing offers a better solution than the electrical system.

Electric drive machinery is a splendid engineering achievement and its mechanical operation is no doubt superior to mechanical gearing. The absence of mechanical difficulties and the smooth flexible operation appeal to the engineer. However, these features are not the chief ones in deciding the type of transmission to install in a vessel. The designer must be guided by comparative data and statistics as to first cost, weight, fuel consumption, cost of operation and the like.

Captain Q. B. Newman, chief engineer of the Coast Guard Service, outlined the experience of his department with electric drive, notably the installation of synchronous motor machinery in the cutter *Tampa*. When it was first proposed to electrify ships of the Coast Guard Service, engineers in the service did not know whether synchronous machinery would be adaptable for starting under heavy loads. To settle the question, the General Electric Company constructed a heavy set of 300 kilowatts capacity for experimental purposes. This set worked with entire satisfaction under test and when it was attempted to wreck the machinery it was found to be practically impossible. The only question remaining was whether in a heavy sea with the propeller out of water and racing the motors would still function properly. Up to the time of the meeting, the *Tampa* had not been out in heavy weather to determine whether the motors would be affected by loads coming on and off as the propeller was lifted clear of the water.

An important factor entering into the decision to install synchronous motors was that the lines of the *Tampa* are fine and would probably not carry the added weight of induction motors satisfactorily.

Fuel consumption aboard the *Tampa* up to the present has been erratic but complete data on her operation will later be available.

The Babcock & Wilcox boilers of 1,400 boiler horsepower installed in the *Tampa* were built for mine sweepers and

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originally intended to supply steam to engines developing 1,300 shaft horsepower. Superheaters were added when the boilers were put into the *Tampa* and the steam generated at higher pressure with the result that the electric drive vessel developed 2,900 shaft horsepower.

In Coast Guard Service rapid maneuvering ability for inshore work is absolutely essential and the drive on the *Tampa* has given an excellent performance in this respect, being able to come to a dead stop from 15 knots speed within her own length and to be at full speed astern in 11 seconds. The response in backing and filling is practically instantaneous.

Elmer A. Sperry, president of the Sperry Gyroscope Company, seemed to feel that it is possible by the use of a new type magnetic air gap clutch to control Diesel engines at low speed, thus making unnecessary the combination of Diesel engines with electric drive. The origin of this clutch idea was in the work of Pomellio, an Italian aeronautical engineer, who developed an elastic link gear for coupling powerful high speed airplane motors to propellers. In this country a magnetic link was substituted for the mechanical elastic link of Pomellio, greatly decreasing the number of moving parts of his system and allowing simpler operation. The device constitutes a comparatively inexpensive gearing for reciprocating engines and takes care of fractional speeds of motors of the Diesel type which cannot operate at low speeds otherwise without drawing on the reserve supply of starting air.

Daniel H. Cox, Secretary

The air gap clutch drives by means of magnetic flux. There are four elements in the form of rings in the magnetic circuit, two of which are driving and two of which are driven. The flywheel proper accommodates an exciting coil producing the magnetic flux. At all fractional speeds or while this clutch is slipping, large currents are generated in the driven element by magnetic induction which act as short circuited secondaries producing heavy drag torques under perfect control by varying the amount of coil excitation. However, when the speed comes up in the vicinity of synchronism, locking occurs and the parts assume positions where enormous pull-out torques are present.

E. A. Stevens, Jr., stated that he considered that the only advantage of the various types of transmission—electric, mechanical gearing or hydraulic—is to run the main machinery at a different speed than the propeller. As the Diesel engine is more reliable as well as more economical at lower speeds it is better to connect direct to the propeller rather than to use any of the transmissions noted. For a slow speed ship of 3,000 horsepower or less the reciprocating engine has shown as good an economy as the average geared turbine and better than the electric drive.

Another thing to consider is the higher grade operators required to handle marine electric installations than is the case with electric locomotive or street car operation, since on board ship the staff must carry out practically all repairs.

Several examples of geared turbine as well as electric drive on naval vessels were cited where each has been found advantageous to fulfill certain special requirements.

Commander S. M. Robinson, U. S. N., felt that members of the society were already familiar with the results obtained with turbo-electric equipment and so in his discussion dealt mainly with Diesel electric propulsion.

By its use it should be possible greatly to increase the reliability of Diesel engines since it will not be necessary to start them up under load nor reverse them. With Diesel electric propulsion it would be possible to use multiple units, thus keeping down piston diameters, increasing reliability and reducing maintenance cost. For cargo vessels of the usual low horsepower it can be said that there will be little difference in the overall economy of the Diesel electric and the direct Diesel drive.

Commander Robinson seemed to feel that the voltage proposed in the paper was somewhat higher than should be used on board ship and that a 3-generator and 2-motor installation would give all the flexibility desired and obviate the necessity for using a high direct current voltage.

E. H. B. Anderson, of the Parsons Marine Steam Turbine Company, referred to the successful trip of the *Eclipse* around the world in which every part of her machinery worked well. However, he said that nothing was stated officially about fuel consumption on this voyage, but there have been rumors that it amounted to as high as 1.3 pounds per shaft horsepower per hour. The boilers were equipped with superheaters for 200 degrees. If this is correct, the showing is rather poor, since double reduction geared turbines would consume only about 0.59 pound of oil per shaft horsepower per hour. As a matter of fact the builders hardly gave this installation a fair chance for the propeller speed decided on was, in Mr. Anderson's opinion, not the most efficient. For an 11,000 or 12,000-ton freighter the most economical speed for the propeller is 75 to 80 revolutions per minute.

Mr. Anderson went on to describe alternative designs for machinery of the *New Mexico* and *Idaho* and the propeller speeds for these vessels. He stated that in high-powered vessels of 28,000 to 30,000 horsepower the use of multiple shafts and the propeller arrangement in direct and geared turbine drive were simply copied by the designers of electric installations, where special designs should have been made to give the greatest efficiency.

Weight, space and economy, in his opinion, were all in favor of mechanical geared machinery and until sufficient data on the operation of electrical machinery are available it is impossible properly to draw satisfactory conclusions.

Electric Auxiliaries on Merchant Ships

By E. D. Dickinson

This paper will be published in full in a later issue of MARINE ENGINEERING AND SHIPPING AGE.

DISCUSSION

F. C. Bates, of the General Electric Company, outlined his experience with the electric cargo handling machinery of the North German Lloyd passenger liner *Prince Heinrich* in 1895. This vessel was probably the first ever completely equipped with electric deck winches. For the first year or two that the ship was in commission, all kinds of trouble was experienced with the equipment, but after changes and adjustments were made in the machinery it was found to be satisfactory. In fact, the winches are functioning efficiently today with a record of twenty-seven years' service behind them.

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G. H. Jett, president, Maritime Engineering and Sales Corporation, agreed in general with the conclusions of the paper dealing with electric auxiliaries and suggested that points to be borne in mind in deciding on equipment are the selection of motors of the proper type and capacity, with special attention to the waterproofing; that the control equipment for all electric motors and apparatus be limited to a minimum consistent with safety in operating devices being used, where practicable; that all protective devices limiting current to motors or equipment be installed in engine room compartments where they will be under the supervision of the engineering staff; that for all wiring not inclosed in conduits as far as practical armored cable should be used.

In the subject of rope speeds the items of greatest importance in selecting machinery are the acceleration and the speed of raising and lowering light hooks. In Mr. Jett's opinion 25 horsepower motors are ample for any cargo winch except in the case of lifts from very deep holds of the largest vessels.

In his opinion Mr. Dickinson has been entirely too conservative in his estimate of the possible economy of electric deck winches for steam equipment, both in the case of fuel for operation and repair costs.

Arthur Barker felt that on motorships electric auxiliaries will reach their widest usefulness and show the greatest reliability and economy. It is be regretted, he states, that we are compelled to refer to foreign-built ships for the principal performance information. Steam auxiliaries have proven to be a complete failure on motorships, a notable example being auxiliary equipment on the *California*.

Mr. Barker agreed with the author in that nothing but the most careful design and best materials and workmanship should be used, as the apparatus is exposed to all sorts of weather and is generally operated by unskilled men. Improvements can be made to equipment in this country by the addition of automatic control. The machinery of the *William Penn* is an excellent example of efficiency.

In connection with the steering gear it is questionable if a more satisfactory electric motor type has been developed than the hydro electric gear. This latter is ideal for control and makes a minimum demand on the generating plant with an efficiency equal to that of any other type.

Referring to the number of engine room auxiliaries and horsepower required, Mr. Barker believed that the following comparison should be given: steamship, 15 motors; motorship, 5 motors; steamship, aggregate horsepower, 160; motorship, 55; fuel consumption, steamship, 41 barrels; motorship, 25 barrels. It is essential that electrical apparatus should be enclosed, particularly rotating parts with commutators. Motors for below deck and engine room service should be inclosed except where size prohibits and then they should be open with protection against drip and condensation from pipes. Starters should be located as close to the motors as possible.

Electric auxiliaries have a place in the steamship when the generators are driven by engines or turbines. Electric auxiliaries only show a saving in the engine room when the generators are driven by oil engines. Adaptability of electric motors has been proven beyond question and the answer to what type ship shall carry the merchandise to the world is the motorship with electric auxiliaries.

Charles Rettie, of Liverpool, Eng., agreed that there is a large use for electric auxiliaries on board ships of the merchant marine and that there can be no question of the advantage of using electric auxiliaries for all power purposes except the actual driving of the ship. The best power for use on board ship is unquestionably direct current, but the tendency lately is to use submersible pumps which can only be run by alternating current. It will be necessary in up-to-date plants to have a rotary converter in the installation.

The number of circuits on a distributing system cannot be reduced with safety, since a large number of circuits must be run to supply the different parts of a ship with light and power. In this country at the present time the tendency is to use screwed conduits galvanized wherever possible in the electric lighting of our ships, and the conduits should be used for carrying wires and cables for auxiliaries.

Mr. McClellan outlined the British practice of auxiliary installations. He also referred to the fact that the British Navy favored the geared turbine rather than electric drive for capital ships and outlined the results with different type drives both in ships of the American and the British Navy.

In his trip across, Mr. McClellan came in a ship fitted with synchronous motor drive and, although the vessel encountered rough weather part of the voyage, no trouble was experienced with the motors when the propeller was out of the water and racing.

He suggested that in America sufficient progress has not been made in insulating the auxiliary machinery; that so far in his experience the only insulation that will successfully resist the action of salt water is mica and micanite, thoroughly baked. He stated that he was in favor of using direct current and two-wire rather than three-wire systems.

H. L. Hibbard, of the Cutler-Hammer Manufacturing Company, stated that the author might have been more specific in regard to certain points which he raised in his paper. For example, no mention is made where the dividing line comes between the types of electric steering gear now in use nor whether the hydro-electric gears for this apparatus have a distinct advantage. It seemed to be his opinion that the direct application of motor drive could be used to the best advantage in horsepowers up to 15 and the hydro electric at 20 horsepower and above. For severe service on deck winches the contactor control is specially suited. It is his opinion that, although safety devices should be omitted as far as possible, stalling devices at least must be furnished with anchor, windlasses, capstans, steering gears and overload contactors or circuit breakers with deck winches.

The advantages obtained from the use of electric drive to all auxiliaries on motorships are now apparent, as well as for deck auxiliaries on steam vessels. The question, however, of using electricity for auxiliaries in the engine room of steam vessels is more debatable.

At this point in the proceedings Mr. Thau replied to the points that were brought up in the discussion of his paper, stating that he would reply to each individual through the secretary and that these replies would be incorporated in the proceedings of the society.

William W. Smith, chief engineer of the Federal Shipbuilding Company, stated that he has found the cost of electric deck machinery to be considerably higher than steam machinery. As given in the paper, the steam consumption is about 50 percent higher than Mr. Smith has estimated for properly designed auxiliaries. Insurance cost for electrical machinery is higher than that of steam equipment and the savings mentioned in the paper would not be as great as estimated, although there is undoubtedly a substantial saving in fuel while in port and a minor saving at sea and possibly a slight saving in supplies, repairs and the like, but, when the higher first cost and other items are considered, the investment in such equipment, in Mr. Smith's opinion, would hardly pay. Steam deck machinery is without question inefficient, as there are large heat losses in pipes and the like. However, it is a great deal lighter and cheaper, and so far appears to have an advantage for steam cargo vessels. For motorships and passenger vessels, however, especially the former, electrical auxiliaries seem to be more suitable.

Rear-Admiral J. K. Robison, engineer-in-chief of the Navy, stated for the benefit of the society that on trial trips, naval vessels having electric drive machinery have given a

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fuel consumption of 0.9 pound per shaft horsepower per hour between 10 and 21 knots; that the best performance on a trial trip ever made was with a geared turbine-engined destroyer which had a fuel consumption of 0.83 pound per shaft horsepower per hour and that the best electric drive record made was 0.86 pound per shaft horsepower per hour. The operating efficiency of the *North Dakota* has not been as satisfactory as expected, due probably to the lack of skill of the staff, which handicap will be overcome. The use of electric auxiliaries on the *Tennessee* has been greatly extended so that in port she has used less than 11 tons of fuel oil per day in driving her equipment.

Mr. Dickinson in reply to the discussion stated that he would refer in detail to the points brought out by the various members in the proceedings of the society.

FRIDAY MORNING SESSION

Admiral Capps opened the Friday morning session of the society at 10:30 A. M. No business came up for discussion so the reading of the papers scheduled for this session was commenced immediately.

How Can American Ships Compete Successfully With Foreign Ships?

By Winthrop L. Marvin

This paper is published in full on page 875 of this issue.

DISCUSSION

James Donald opened the discussion by giving operating statistics of American vessels and amplifying details brought out by Mr. Marvin and bearing out his statements as to the cost of keeping our ships in condition to compete successfully with foreign powers.

In this discussion the effect of employing foreign labor on American vessels was demonstrated.

Mr. Marvin replied to the statements in this discussion saying that the statistics presented would be of great service to the merchant marine. He referred to the conditions before the war when all sailors of the grade below the rank of licensed officers could be of any nationality. When the foreigners shipped in American vessels during this period they demanded the same rate of wages as American seamen and their work did not compare in efficiency with that of our own men.

He pointed out that during the month of October this year 97 percent of all men shipped on American vessels were American citizens, giving a higher proportion of unlicensed American seamen than ever before.

Mr. Marvin was very much in earnest in his statement that the merchant marine of this country could never expect support from Congress while it was manned by cheap foreign labor.

Mr. Donald declared that Mr. Marvin had given a scale of wages for American and foreign ships which even with the present exchange rates in favor of American currency showed that the operating schedules for ships of this country were higher than in any other. What the American merchant marine requires is more freedom in regard to the nationality of the crew and American shipowners should be allowed to employ cheap alien crews as other nations do. He then demonstrated on the screen the present commercial value of freight steamers of an average of 7,500 tons deadweight, giving the figure of $20 per ton deadweight. To bear out this figure he gave the chartering value for British and American steamers at the present time which indicated that to operate successfully the original cost could not be greater than the $20.

He also compared the cost of exporting coal in American and foreign steamers which indicates a loss to the American vessels of $1.82 per ton which completely eliminates our ships from this trade. In conclusion he stated that it is impossible at the present time for American steamers to compete with foreign steamers and that if it is necessary to adopt a subsidy for our ships it will mean an annual payment by the Government to overcome the extra wages on our vessels of a sum amounting to $31,680,000 per year. Conditions are very serious for obtaining new contracts for the shipyards and selling surplus steamers belonging to the Shipping Board and also the possibility exists of American shipowners controlling high price tonnage and chartering them at the present low freight rates, causing a heavy loss to the industry.

One thing that the Shipping Board should do is to determine a fair replacement value for tonnage and sell it at such a figure as will allow its economic operation.

H. C. Towle pointed out that in his experience the replacement value of vessels in at least one yard in this country is lower than it is in England, citing as examples a 10,000-ton tanker and a 9,000-ton freighter which were built in England at a price $6 to $8 a deadweight ton greater than in this country. It is essential after determining a fair replacement value to keep our ships operating in order firmly to establish our export trade.

The British are afraid of our dumping surplus tonnage on the market and their being bought by Norwegian and German operators.

W. H. MacKay, chief engineer, seemed to think that the great trouble with ship operation at the present was due to the existing seamen's laws which, while piling up the cost of maintaining a crew, cut down their efficiency. He stated that shipbuilders and designers by putting in a lot of superfluous fittings and luxuries for the men increased the building costs to too great an extent. He compared present conditions of seamen with those of the years when he first shipped in the engine room of a cargo vessel, pointing out that the waste today in materials by incompetent crews was greater than ever before.

Captain D. A. J. Sullivan, master of a successfully operating cargo vessel, declared that with an intelligent crew, proper support from the owners and control over repairs and maintenance there was no reason why American ships could not compete with foreign vessels. In his own case, the vessel which he now commands was bought during the period of high tonnage prices at $225 per deadweight ton. The ship is manned entirely with Americans and six of the eight officers are college men, seven of them having served during the war.

In two years, the operating cost has been reduced to a remarkable extent, fuel consumption being cut from 42 to 28 tons per day. At the same time the average speed was increased from 9.4 knots to 10.8. The entire wages of the crew, which is the highest type of any in American ships, is $2,300 per month less than on a Shipping Board vessel of the same size. Among other things, on this vessel a lot of the fancy equipment described by the previous speaker has been taken out of the vessel to prevent possible waste; for example, hand pumps were installed in place of the steam driven equipment and the original fresh water consumption of 162 tons for a voyage was cut to 14 tons.

The big items of expense, in his opinion, which make it impossible for American vessels to compete successfully with foreign ships are the cost of insurance, the cost of handling materials in transfer from the ship to other carriers, unnecessary detention in port, lack of personal contact between the owners' offices and the officers of the vessel and repair charges which are exorbitant.

Captain Sullivan stated that he had found it necessary, while his vessel has been undergoing repairs, to remain in constant supervision of the work so that it might be pushed rapidly.

The matter of turn around is also of the greatest import-

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ance and he stated examples of the length of time taken to clear his vessel from port during different voyages, indicating that with close supervision of the work, the time might be cut considerably. During the war he had control of the operation of 300 colliers at Tyne and Cardiff, Wales, and during this period was able to gather operating statistics of great value and to determine the various factors entering into overhead cost.

The American shipping industry should not ask for protection against any extravagance of its own and, if American ships are manned by an intelligent crew and conscientious officers, the results in spite of higher wages are much better than if operated with foreign labor.

The Importance of Port Facilities in the Development of a Merchant Marine and Commerce

By Rear Admiral H. H. Rousseau, U. S. N.

ABSTRACT

IT is an accepted traffic law, advanced by the late James J. Hill, that the volume of traffic a line can carry cannot exceed the capacity of its terminals. Unless and until our ports and port facilities are further developed and put on a thoroughly efficient operating basis, the growth of our merchant marine will be much retarded.

Delays in port mean lessened revenues and increased expense to ocean carriers. The increased cost due to unusual delays—which may in general vary from $1,000 to $5,000 per day per vessel—cannot be passed on to shippers, and has to be borne by the steamship companies themselves.

In our coastwise domestic commerce, the higher the cost of the operation of port facilities the more closely will the cost of water transportation approach the cost of transportation by land, and the greater will be the volume of traffic diverted from steamships to railroads.

The following may be given as some of the important characteristics that our ports and port facilities should possess from the standpoint of the interests of our merchant marine and our commerce:

1. The use of deep-water frontage should be restricted to the commercial business of the port.
2. At least half of the deep-water frontage should be publicly owned or controlled.
3. Berthing, handling, transferring, switching and storage facilities should be convenient, efficient and economical; they should be ample to carry any probable peak load.
4. There should be complete flexibility of movement between any and all water carriers and any and all land carriers, and *vice versa,* as well as from any water carrier to another.
5. The port charges should be reasonable; should be as similar as practicable, both in manner assessed and in amount, for all of our ports; and should be based upon actual cost of the service performed, including interest on investment and overhead. For ports under unified public control, the charges should be without profit.
6. All the facilities of the port should be under one control, which preferably should be independent of the local government. The port authority should be animated solely by the aim to conduct the port business as an efficient link in our sea-borne commerce and in thorough sympathy with our national policies for a merchant marine.

In an article such as this, it would be impossible to give a detailed description of port facilities. It is sufficient to say that the principal port facilities include necessary piers and wharves equipped with transit sheds, overhead cranes and other necessary handling devices. The distribution of freight to and from each wharf is attained by tying up the railroad terminal yards with each other and with the water front by the means of so-called outer belt line railroad. Communication between piers themselves should be attained by an inner belt line, which may be on land by railroad or on water by lighters, or by both. The port should be equipped with sufficient warehouse and storehouse facilities, for reservoir purposes, and to eliminate the uneconomical expedient of using freight cars as storehouses.

DISCUSSION

Captain F. T. Chambers, C. E. C., U. S. N., emphasized several points brought out in this paper, first pointing out that the terminal is the bottle neck of the transportation system and as such must have sufficient capacity for the assemblage and classification of commodities and the piers should be properly designed to afford the quickest turn around for ships. All piers should be arranged for an adequate amount of railroad trackage, a 1,000 to 1,300-foot pier being at least 500 feet wide to permit tracks on each apron and down the center of the structure.

About two years ago the port facilities commission of the Shipping Board took up the subject of economies possible by a more rapid turn around and found that all charges for the vessel while in port, including depreciation, insurance, wharfage charge, port payroll, etc., amounted to $2,066.26 per day. It was felt that no record would have been broken, if the complete port turn around of the vessel in question had been 6 instead of the 15 days required, thus allowing a saving in expenses of $18,596.34.

Special type vessels for handling bulk cargo have been designed so that turn around can be accomplished in a few hours. The proper handling of miscellaneous cargo, however, is not so simple but proper design of our port terminals plus efficient operation and management will unquestionably produce excellent results and have a great bearing on decreasing the operating cost of our merchant marine.

William J. Wilgus declared that operators have not given the attention necessary to the matter of terminal facilities, expecting that someone else would look after the matter of efficient equipment. It is just as essential for the railroads to consider the terminal question as for ship operators since the pier or quay is a joint terminal at which land and water carriers meet for interchange. The neglect to plan and build the proper terminals, equipped with efficient apparatus, results in lengthened turn around for ships, the duplication of operations, the detention of rolling stock for the railroad and unnecessary delays for the motor truck.

He seemed to feel that the Federal government should take more active interest in the development of suitable connecting links between the land carriers and ships.

Unified management in the form of a port authority at each important seaport can effect important results in these developments, the authorities of London and Liverpool and of the port of New York being excellent examples of organizations which are operating successfully in the management of terminals.

Prompt and effective action and cooperation on the part of the Federal Government is absolutely essential to the stimulation of intelligent planning and creative work at every one of the gateways at which the nation as a whole has so much at stake.

Benjamin Thompson, president of the American Association of Port Authorities, declared that the administration of port facilities is too often placed in the hands of men who have had no training whatever in port affairs—matters which require careful and continued study and problems that demand close observation. Too often, efficient men in charge of port work are removed for political reasons and replaced by men who know nothing at all of the work. In his opinion the business and administration of a port should be conducted just as any other business involving the use of tremendous amounts of capital.

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Congress in the enactment of the River and Harbor Act, March 2, 1919, and the passage of the Merchant Marine Act of 1920 has made a very important beginning of what it is hoped will eventually result in port administration throughout the country being placed upon a strict business and accountable footing. Information will soon be available on the port facilities of the country which has been prepared by the Bureau of Engineers under the chief of engineers of the United States Army. With this information available it will be possible to formulate conclusions as to some general form of port organization and administration that will be satisfactory.

Exporters and importers should be in close touch with those who administer port affairs. The American Association of Port Authorities is ready and willing to do its share in helping solve the problems that confront every port administration and invites all of them to join with the association in determining what is the best to be done that transportation by water, export and import commerce can be conducted most quickly and most economically.

Rear-Admiral F. R. Harris, U. S. N., outlined the necessity for improving our merchant marine with the idea of increasing our export and import trade. It is one of the important links in our transportation system and in order to build up a large foreign trade we must not only be able to manufacture cheaply but must also deliver our goods economically to compete with foreign purchasers. Freight charges, as is well known, are higher in American vessels than foreign, one of the principal features causing this being excessive terminal costs for handling material. Terminals should be improved not alone for rapidly and economically loading and unloading vessels but also in regard to the capacity of the terminal—that is, the number of vessels and cargoes unloaded simultaneously.

Admiral Harris referred to certain agreements between the railroads and foreign steamship companies, pointing out that we should be able to offer through rates in American vessels in competition with foreign vessels low enough to induce the railroads to cooperate with our ships.

The whole matter of foreign trade, merchant marine and port facilities is much involved but is a single problem and not three separate ones. We must be cautious and careful in our capital expenditures as regards productive plant, vessels, port works and terminals.

Charles E. Fowler, consulting engineer, stated that the seven postulates of the Montreal Harbor Commission, as given in their original report, cover the situation as to any important harbor most comprehensively. The first two are repeated here:

"The ports that are doing the biggest business and doing it most efficiently are the ports that have kept their facilities ahead of actual requirements.

"The ports that have remained stationary or lost prestige are those which neglected to provide facilities before business was forced to seek elsewhere the same facilities provided by rival terminals. Business follows the facilities."

From his experience with the Seattle Harbor Commission, Mr. Fowler sees no reason why the port authority should not be separated from any connection with municipal government—in other words, from politics. The port development plan in Seattle has worked out satisfactorily in every respect.

Any port will be a failure if the hinterland does not produce and consume material conducive to ocean commerce and this territory must have the necessary connecting or feeder railways. Railway and port facilities must cooperate in every way possible as is done in certain South American countries where for example the roof and doors of box cars are arranged to facilitate loading and unloading.

To reduce the overhead of ship operation such items as stevedoring, repairs, fuel and wages should all be made to show an improvement. We may rest assured that our merchant marine will not be a success until there has been a radical revision of our shipping laws.

The major problems of port location and arrangement of facilities together with the general design of harbors are ones which have not been given sufficient attention in the United States.

The task of forming a real merchant marine unit of our transportation out of such a heterogeneous mass of land carrying systems and port or harbor facilities is a tremendous one, but one worthy of the best minds among engineers, business men and statesmen.

Calculation of the Transverse Strength of Submarines by Marbec's Method

By Professor William Hovgaard

ABSTRACT

THE French naval constructor Marbec in 1905 contributed an essay on "Dilatation des Tuyautages" to Mémorial du Génie Maritime, in which he dealt with the strength of closed elastic rings of uniform section and of relatively small transverse dimensions by a method based on the fundamental work of M. Maurice Lévy. In Bulletin de l'Association Technique Maritime for 1908, in a paper entitled "Théorie de L'Equilibre d'une Lame Elastique," he developed the method further and applied it not only to a simple closed ring but also to arches. The method was for the first time, I believe, explained in English by Marbec himself in 1911, when he read a paper before the Institution of Naval Architects, "Notes on the Collapsing of Curved Beams and Curved Elastic Strips"; and in 1921 Mr. W. R. G. Whiting published the results of an application of the method to elliptical forms in a paper, "The Strength of Submarine Vessels," read before the same institution. In Germany Marbec's method was explained and applied to arches by Dr. Rudolph Mayer in Zeitschrift für Mathematik und Physik, 1913.

I shall endeavor to explain the method as briefly as possible, without following all the interesting side issues of M. Marbec, including only the steps necessary to an understanding of the method and its intelligent application to problems occurring in the design of closed frame rings, and more especially of frames in submarines, in cases where the resultant effective forces can be assumed to be equivalent to a uniform pressure all around the circumference. The proof here given is direct and simple and is essentially that given by Dr. Mayer. The method of application I have developed into a form which I believe is suitable for practical purposes and is exemplified in plates accompanying the paper.

Marbec's method is based ultimately on the same fundamental formula as that used in my work on "Structural Design of Warships" in the treatment of the closed frame ring.

$$d\theta = \frac{M}{EI}$$

The explanation of Marbec's method as given by Professor Hovgaard is of a highly technical nature and will form a valuable addition to the official proceedings of the society, where it will be published in full.

Cost Accounting and Estimating

By H. H. Schulze

This paper will be published in full in an early issue of MARINE ENGINEERING AND SHIPPING AGE.

DISCUSSION

Professor Sadler of the University of Michigan seemed to think that the value of this paper could be greatly increased if Mr. Schulze would make available the coefficients of cost and weight referred to. Such coefficients would be

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useful as a basis on which to develop similar coefficients for estimating on practically any type vessel.

J. T. Dolcher stated that the chief function of the estimator is to work out as accurately as possible the actual cost of a proposed ship based entirely upon previous cost records obtained from the accounting department. Where such records are not available the estimate is based entirely upon previous experience.

Although the primary function of the accounting department is to furnish information to the management the fact should be emphasized that the more accurate the data turned over to the estimating department the more accurate and reliable the estimates will be. The general tendency of the accounting department has been to neglect this item in the past.

It is essential that the estimator be prepared to make a quick and reliable estimate based on information usually available in the form of specifications. A quick and reliable method of computing curves to cover the cost of various details such as piping systems and the like is essential. The efficiency of an estimating department is directly based on the amount and quality of information in the form of tables and curves on hand and the methods proposed to attain that end by Mr. Schulze are to be highly recommended.

T. M. Cornbrooks, New York Shipbuilding Corporation, stated that he had been impressed by the fact that no authentic attempt had been made until a few years ago to properly analyze costs and to work up factors which would be available for estimating purposes. The scheme which was formerly used was to analyze every ship which had been built both to determine the factor for estimating the material involved in a ship of similar design and for labor. Also to tabulate all standards such as side lights, deck scuttles, valves and the like so that estimates could be worked up quickly or the costs be entered per unit.

We analyzed the return costs of each ship as completed by first checking the materials charged on the drawings and orders and then from this analyzed the labor cost on the unit basis using an empirical formula for this purpose which was tested out on a number of different type ships before it was adopted as a standard. In analyzing the labor cost, we used both the hour and dollar cost as a unit, finding in ordinary times when the wages did not fluctuate that it was quicker to use the dollar unit and during an unstable period to use the hour unit.

By comparing the unit hour or dollar cost of various ships we were enabled to judge the efficiency of the various trades and the various contracts.

For the factors used in determining the coefficient for working out the hull steel weights we had our line man who worked on the marble slabs determine this as part of his job of laying down and fairing the lines so that our data were always up to the minute.

Too often the attitude of the accounting division is that the accounts should be kept in such shape as will satisfy their requirements only. To secure full advantage of the money spent in keeping costs they should be arranged so that the management can analyze them and determine the efficiency of the various departments as well as the various designs. In regard to comparing costs and data from different yards there is no standard subdivision of costs in use; for instance, some yards keep the steel hulls complete while others keep only the main structure in one item and lump the doors, hatches, etc., in with other miscellaneous fittings.

FRIDAY AFTERNOON SESSION

At the afternoon meeting Dr. W. F. Durand, honorary vice-president of the society, presided. The names of fourteen applicants for membership and three for associate membership were recommended for election by the council and were unanimously elected by the society.

Design and Construction of Passenger Steamers

By E. H. Rigg

This paper will be published in full in the January issue.

DISCUSSION

Dr. H. C. Sadler, professor of naval architecture, University of Michigan, pointed out that the size and speed of future vessels will be determined not by structural and power limitations but by the economic aspects of the service for which the vessels will be built. The mere question of size need not bother the naval architect today and we know enough about speed and power to predict results accurately under known conditions but details of passenger arrangements and the like will be studied more minutely than before so that it will not be necessary to go to extreme size for the desired capacity. In speaking of speed Dr. Sadler referred to the fact that we have a competitor for speed in the air ship, and questioned the advisability of attempting to strive for higher speeds in crossing the Atlantic by water.

Hugo P. Frear, naval architect, Bethlehem Shipbuilding Corporation, Ltd., remarked that this is an opportune time for the consideration of passenger steamers on account of the shortage of this particular class of tonnage as confirmed by the large number of inquiries for plans and prices for vessels of this type during the past two years. A considerable number of contracts would no doubt be consummated with little delay, if the purchaser was assured that present costs and rates would prevail for several years. Not only does this apply to passenger steamers but to many vessels suitable for special trades, some of which have been referred to in the paper. While it is true that the present high costs of construction and operation have put a damper on the building of floating palaces of the largest and fastest pre-war types, it is not understood that even vessels such as the *Mauretania, Aquitania, Imperator, Vaterland,* etc., were especially profitable before the war or compared favorably in return on the investment with intermediate types of the *Adriatic* or *Franconia* class. The largest and fastest pre-war types were the result of keen competition from an advertising point of view between Great Britain and Germany and also between steamship companies. The cost of advertising is now too great to indulge in on such a scale.

It is doubtful if the trend of design for intermediate steamers or passenger steamers for special trades is towards smaller dimensions or slower speeds. The average dimensions and speeds for the Pacific trade have certainly been materially increased and at least in one case for that trade, still larger and faster vessels are contemplated. Designs for new steamers, larger and faster than any previously employed, have recently been completed for not less than four different trade routes. Designs were also submitted not long ago for a steamer to cross the Atlantic in less than three days. This steamer, however, was not to cross at the widest part of the ocean.

In connection with the cost of high speed and fuel savings possible for high speed, moderate dimensioned vessels, it is not clear whether or not 760 feet is recommended as the limit of length up to 30 knots. The table on page 13 of the paper seems to indicate that 760 feet might not be the most desirable limit. This table also does not seem to offer convincing proof of fuel savings possible for high speed, moderate dimensioned vessels. The 600-footer may be considered a moderate dimensioned vessel but it is difficult to see from what point of view there is an economic saving in fuel as compared with the 1,000-foot vessel with a difference of only about 16 percent in shaft horsepower and something like a difference of 200 percent in displacement.

David Arnott, deputy chief surveyor, American Bureau of

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Shipping, in commenting upon the particulars given of the 1,000-foot liner, stated that the comparatively narrow beam of 105 feet in association with a length of 1,000 feet and a depth of 76 feet is going back to the proportions of the Atlantic liners of a generation ago and does not appear to accord with the trend of later practice with regard to increased breadth. If 76 feet represents the depth to the uppermost complete deck, he continued, it would be interesting to know how many tiers of deck houses were to be superimposed on this deck. In a 1,000-foot ship designed to travel at a speed of 30 knots, the panting arrangements at the ends and the anchoring of the large deck houses would require to be given very careful and special consideration if trouble is to be avoided in these particular neighborhoods. Mr. Arnott also took issue with Mr. Rigg as to the effect on the weight of increasing the breadth and fining down the ends in a vessel of the same length and depth and suggested that the increase in weight over the corresponding vessel of normal proportions and block coefficient would be quite considerable in cases where the scantlings are required to be taken direct from the tables in association with a system of numerals. Referring to standardization Mr. Arnott pointed out that the new British standard sections provide British shipbuilders with a much more economical range of shapes, especially bulb angles and channels, than we have available for shipbuilding in America. As the adoption of a single line of up-to-date channel sections for all structural purposes in this country would be advantageous for both shipbuilders and structural engineers, he hoped that our steel manufacturers can be persuaded that this course will also be in their own interests. Other aspects of standardization in foreign countries with regard to shipbuilding and engineering, such as Scotch boilers, marine reciprocating engines, ship fittings, etc., received favorable comment and it was suggested that the matter is worthy of the very earnest consideration of American shipbuilders and engineers. Mr. Arnott was pleased to have Mr. Rigg's opinion that the recent revision of the rules of the classification societies has placed in the hands of the shipyards methods of designing structure and details which enable much quicker and better work to be done.

W. W. Smith, chief engineer, Federal Shipbuilding Company, in referring to the author's statement that electric drive was first contemplated for the 1,000-foot liners, stated that from his investigation he would estimate roughly that the weight and cost of the electric drive machinery would be from 70 to 80 percent more than the geared turbine propelling units, and that the steam consumption would be from 4 to 8 percent greater. The latter would also reduce the weight of boilers, auxiliaries and fuel to a slightly lesser extent. He emphasized especially the large economic advantages of geared turbines and high superheat. If we compared a geared turbine installation using steam superheated to 200 degrees with a well designed triple expansion engine installation using saturated steam, it will show that the weight and cost of the engine installation will be about 80 percent more than the turbine installation, and that the saving in fuel consumption of the latter will be about 30 percent. With geared turbines and high superheat, a fuel consumption of 0.85 to 0.90 pound per shaft horsepower should be obtained for installations up to about 30,000 shaft horsepower and above this, from 0.80 to 0.85 pound should be obtained. Mr. Smith concurred in Mr. Rigg's views on standardization and thought that large economies could be effected by efficient standardization in machinery and detail parts.

Walter M. McFarland, manager marine department, Babcock & Wilcox Company, and president-elect of the society, called attention to the increasing use of watertube boilers in passenger liners and the savings in weight of machinery and other economies that are possible from this source.

Commander T. Kawahigashi, of the Japanese Navy, in a written discussion read by Lieutenant-Commander Sasai, I. J. N., expressed satisfaction that a large number of the ships of the *American Legion* type are destined for Pacific service, where they will undoubtedly play an important part in increasing the trade and consequently the friendship between the United States and Japan, and in bringing these two countries closer together by an ever decreasing distance. In speaking of experiments with model propellers he pointed out how fortunate we are in this country to be given the benefit of the experiments carried on by the Navy; where the Navy is willing to share the results of what is done experimentally with private shipbuilders, the art of naval construction is bound to make rapid progress. The recent tendency to decrease the length of passenger ships he believed to be only a temporary phenomenon of post-war reduction and prophesied that it will soon return to the pre-war condition. Mr. Rigg's opinion regarding the advisability of increasing the breadth of a ship he pointed out as another indication of how we are profiting by the lessons learned in the great war. By increasing the breadth beyond the proportion usually accepted, greater stability is secured and the life of the ship is safer. Commander Kawahigashi gave details of the electrically propelled tanker which is being built by the New York Shipbuilding Corporation for the Japanese Navy, and stated that undoubtedly electrically propelled ships are going to play an important part in future naval construction and it is gratifying to know that the Japanese Navy is getting its first lesson in this development from the United States.

E. H. B. Anderson, of the Parsons Marine Steam Turbine Company, expressed the hope that a second paper on the Design and Construction of Passenger Steamers would be presented before the society at a later meeting which would deal more fully with the machinery for the class of ships described by Mr. Rigg.

Elmer A. Sperry, president, Sperry Gyroscope Company, predicted that Diesel engines are going to propel our ships in place of steam machinery. He said that the development of 12,000 horsepower in 6-cylinder Diesel engines is now in sight.

Written discussion was also submitted by H. F. Norton, naval architect, Newport News Shipbuilding and Dry Dock Company, and C. E. Petersen, naval architect, United States Lines, but not read on account of lack of time.

The Influence of Shape of Transverse Sections Upon Resistance

By Professor H. C. Sadler and Professor E. M. Bragg

This paper will be published in full in a later issue of MARINE ENGINEERING AND SHIPPING AGE.

DISCUSSION

Several speakers, including Professor L. B. Chapman, of Lehigh University, Hugo P. Frear, naval architect, Bethlehem Shipbuilding Corporation, Ltd., and E. H. Rigg, naval architect, New York Shipbuilding Corporation, expressed their appreciation of the authors' work in presenting this very valuable paper to the society. but stressed the point that some standard method of presenting such results would be highly desirable.

A. J. C. Robertson, naval architect, Munson Steamship Line, complimented the authors upon the value of their work in this paper and went on to say that a good model freight ship has been used as a starting point and that model has been varied radically in the shape of the transverse sections in the fore and after bodies and in addition the lengths of these bodies are rearranged to the whole ship length; and

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all the models have been tested at four different drafts, and the results furnished except in one case.

The first set of results, from a full form of long run and a fine form with equal entrance and run, shows each with two kinds of stern and one bow, and also with two kinds of bow and one stern. The variation of the stern lines shows, in general, very small change in the resistance values but in general the U-shaped stern with the consequent narrower water lines shows up somewhat better. This permits shipbuilders to indulge in a reasonable amount of club foot of the stern lines, permitting more rigid support to the propeller shaft and somewhat easier lines above water, preventing the slamming which occurs with a full counter when the vessel is making its way against a head sea.

The variation in form is much more interesting where the bow is changed and in general the results also help the naval architect because with the fuller model the V-shaped bow shows up considerably better than the U-shaped bow for the useful range of speeds; whereas in the fine model the U-shaped bow is the best. This apparently indicates that a certain amount of fullness is desirable near the base line irrespective of the fullness of the waterline, but that excessive fullness, which is fatal to the ship's structure in head seas, is also bad for the ship's propulsion.

The results from a single model shown at four different drafts throw a great deal of light upon the problem of U- and V-shaped lines. Quite apparently the variation in the bow sections is the more important one, and considerable savings in power can be gained by the adoption of the correct transverse form. At very large drafts the difference between the V bow and the M bow is very much less than for the lesser drafts,—this curious feature is in accordance with the observation I have made in analyzing other models. A fullness of transverse section in the underbody affects the resistance in proportion to its nearness to the load waterline. It is customary to think of the residuary resistance of ships as wave-and-eddy-making, and though we have no means of measuring the relative amounts of these resistances, this practice is a good one. That part of the ship which is sufficiently far under the surface has relatively little to do with the development of the diverging waves, which are always lost, and the transverse waves, which may be lost or may be, in a large measure, recovered according to the length of the parallel bodies adopted. If the lines low down are shaped for eddy-making only, the result will be good providing the draft of the ship is sufficient, but at the lighter drafts wave-making is set up and interferes with the normal resistance of the ship.

In Mr. Robertson's opinion Figs. 6, 7, 8 and 9 will probably be considered the most valuable part of this very valuable contribution. They represent an enormous amount of work and provide the greatest assistance to the designers of full form ships, as they enable the designer at once to select the fullness of model satisfactory for any given speed at any given draft and provide him with resistance figures corresponding to the model. As for Figs. 4 and 5, the prismatic coefficient varies throughout this series and therefore the resistance curves are composite ones representing an optimum model with constantly varying fullness to suit its particular speed.

Mr. Robertson criticized the authors' method of presenting the tank tests on the ground that the conversion of the results of this paper to any other standard method of presentation is going to be quite a serious matter. He also believed that the resistances should have been presented for a standard vessel 400 feet long, as in other papers, and that they should have been reduced to a constant temperature of 70 degrees, as used at the Washington tank. The most serious criticism of the whole paper in his mind, however, had to do with the actual quantitative results themselves. These are expressed as EHP upon displacement, divided by the cube of the speed ratio. This system, which is quite novel and therefore useless for comparison purposes with any previous results, he contended, is also without the one advantage claimed for it, that it is suitable for ready application by the busy naval architect who does not specialize on ship resistances. This form of expression gives serious differences for very limited changes in draft and is impossible of application for any important changes in length, and therefore the data presented is very limited in its application; even a 12 percent variation in length above or below that at which the results are given shows 1 percent variation in resistance and other drafts than those presented could only be obtained by the use of cross curves. The advantage of experimental tank results is largely that it enables a designer to choose the minimum dimensions of a vessel for a given duty and that the economies so effected are usually greater than the economies gained by a slight variation in the resistances of a vessel of fixed size. Any investigation along the lines of variation of ships' dimensions must be carried out on a different basis than that on which these results are presented. Anyone who has had any experience with the Froude "C" Constant System will realize how very much superior it is to the one here used.

Power and Speed Trials of Ten Thousand Deadweight-Ton Tanker

By H. A. Everett

This paper will be published in full in an early issue of MARINE ENGINEERING AND SHIPPING AGE.

DISCUSSION

Professor E. M. Bragg, of the University of Michigan, declared that the data contained in Professor Everett's paper were extremely valuable, especially for those interested in propeller work. Information on the wake of the vessel is all that is lacking to make the test complete. It so happens, however, that the results of towing current meters after a model of the tanker at the University tank to determine the characteristics of the wake are available and will amplify the tests so they can be used for almost any purpose of comparison in getting out new designs. The paper also gives an excellent outline of engine performance, but it would be helpful if the clearances at the top and bottom of the cylinders and the designed cut-offs were given.

Model tests are run on a length to breadth ratio and if data on the lines were given in the case of a test, the results could be used to better advantage—that is, whether the sections were U- or V-shaped in any particular model.

E. H. Rigg, of the New York Shipbuilding Company, stated that this paper was the most complete record of the actual performance of a ship as compared with her model tests that has ever been prepared in this country. He added that test runs should be made in sets of three to eliminate type variations. This was done with the tanker described in the paper. Results of tests to determine the effect of the wind are now being analyzed by the New York Shipbuilding Company and will be contributed to the proceedings of the society within a short time.

Rear-Admiral D. W. Taylor, U. S. N., chief constructor of the Navy, in a written communication, stated that he was interested in the method adopted for running trials. The corrections for wind effect constitute a new departure in this work. By dealing, as the author does, with curves of mean effective pressure plotted as revolutions, the wind effect can be reasonably well eliminated. Also, if the slip is assumed to be constant, the method used for correcting the speed curves for wind effect will be quite close to actual conditions.

The efficiency of propulsion deduced by Professor Everett would be slightly higher if the actual effective horsepower for the trial displacement had been used.

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Another factor never before subjected to analysis is the effect of the rudder. When the rudder is put over, it constitutes a powerful brake and there is a material difference between the speed and power curve with a good helmsman and with a poor helmsman. Data on this subject from members of the society would be of great value.

American Shipyard Apprenticeships, Evening Schools and Scholarships

By Charles F. Bailey

ABSTRACT

APPRENTICESHIP in shipbuilding is generally in vogue in the older established shipyards of this country. Some yards have had apprentice courses for many years, but only within the later years has there been any considerable interest in the matter, and even at this time there is an opportunity for advances which would be of benefit to both the apprentices and the yards.

At present the various yard apprenticeship regulations are quite similar and include a considerable course of study, in most cases as a part of the system; in some yards independent evening schools are maintained for the benefit of the apprentices and other employees, both male and female.

A movement is now under way to offer, as an incentive to apprentices, short scholarships in higher institutions of learning, which may be won by competition.

Trades in which apprenticeships are offered are as follows: anglesmith, blacksmith, boiler maker, coppersmith, draftsman (construction), draftsman (engineering), draftsman (hull), electrician, joiner, machinist, machinist (steam engineering), molder, pattern maker, plumber, sailmaker, sheet metal worker, ship carpenter (including shipwright work, boat building and spar making), ship fitter (including mold loft work), ship rigger, welder (electric and acetylene worker).

The length of course is usually designated as four years, sometimes of a certain number of hours per year. A number of companies have provisions for credits by which the length of the course may be reduced to a minimum of three years by reason of special proficiency and all-round excellence.

Qualifications necessary for training are stated by various yards thus: average alertness, a good grammar school education, ability to read and write, familiarity with arithmetical processes, satisfactory personal presence, of such stature as to fit them for the trade selected, each candidate required to pass a physical examination by the company's surgeon before entering the apprenticeship and a similar examination annually thereafter during the apprenticeship.

No definite rule has been generally adopted as to the number of apprentices in the various shipyard trades. This is largely accounted for by the uncertainty of the work whereby the number of employees has varied greatly due to trade conditions and requirements for naval and merchant work. In slack times it is best to retain as many apprentices as possible, only weeding out those least desirable.

Supervision is handled by various methods. In one yard a supervisor of apprentices has general oversight of all the apprentices throughout the yard and is the principal of the school work; under him are several instructors. In the shops apprentices are instructed by mechanics who especially look after a number of boys, assign them work and instruct them in the correct method of performing the work, operating the tools, etc. Promotion is based on the rating from monthly reports from the various shops and for school work. In some cases the shop work counts double that in the school.

Pay of apprentices varies in the different yards, ranging, as compared with first-class journeyman wages, from about 30 percent for the first six months to 80 or 90 percent for the last six months. It is usual to increase the pay on the completion of each six-month period so that for a four-year course there are eight grades. At some yards the pay ratio is higher at the beginning and less at completion than given above.

At the end of the apprenticeship course it is usual to provide a bonus, varying from $50 to $100, for satisfactory completion. In some cases where the apprentice is obliged to leave before the completion of this time, otherwise than due to neglect of duty, disobedience of rules or other improper conduct, the apprentice is paid such portion of this sum as the time served bears to the total term of apprenticeship.

In addition to the apprenticeship schools some yards in conjunction with the industrial Y. M. C. A. of the community or with other organized bodies or vocational schools, conduct evening classes to which the apprentice boys may or may not be eligible. These classes are not usually self-supporting. They should have the highest grade of talent in the director and in the teachers; and frequently this is easily obtained in large yards by drawing on the trained, technical college graduates, who are willing to give their time for a reasonable remuneration. Such schools are largely attended by workmen and young women, and some of the apprentices also take advantage of them for advanced work and for fitting for college.

SCHOLARSHIPS

Some employees welcome an opportunity for advancement dependent upon their individual efforts and competition. In line with this it is suggested that large shipbuilding companies give consideration to the establishment of a small number of scholarships as follows:

(a) A four-year course covering work in language, mathematics, physics, chemistry, metallurgy, electricity, marine engineering, naval architecture or allied subjects in an approved university, technical school or institute, granting the degree of bachelor of science.

(b) A two-year course covering similar work in several of the above subjects in an approved university, technical school or institute.

(c) A one-year course covering similar work in several of the above subjects in an approved university, technical school or institute.

(d) A home correspondence school course in an approved correspondence school or a course of thirty-six weeks in the industrial Y. M. C. A. evening preparatory school of the city.

Examinations for these scholarships to be held at suitable intervals.

With companies employing several thousand men it should be the aim to recruit both their technical staffs and managerial staffs as largely as possible from their own employees. The establishment of scholarships (b), (c) and (d), as outlined above, has been authorized by one large American shipbuilding company and the details of this work are being developed with the intention of announcing these scholarships so that a few of them may be competed for and granted within the next year.

In solving this problem of supplying our shipyards with men possessing manual skill, as well as technical and theoretical ability and knowledge, it is well not to overlook home talent, familiar with the work of the home yards and whose ties are largely there. Such young men are in line for more valuable service to the company than those who are only highly technically educated or manually skilled or without the community ties. The combination of these qualifications is a step in the direction of efficiency and progress.

A novelty in apprentice training has been introduced by the General Electric Company at Lynn, known as the cooperative course at the Massachusetts Institute of Technology. By the cooperative plan the apprentice alternates three months with the Institute of Technology and three months in the apprentice shops. This course has been arranged to

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cover a period of two years. A similar arrangement is in vogue with the Westinghouse Company and a leading university, and I understand some of the locomotive companies have also followed such a procedure with success.

This matter of apprentice training and education is one of great human interest and, if properly accepted by the shipbuilding companies, it is certain to strengthen the morale, reduce the turn-over and benefit both employers and employees. It should not be looked upon as social work but as a business proposition. Many large organizations now see that business with service is most desirable; here will be found a field for both.

DISCUSSION

E. H. Peabody declared that the shipbuilder was not altogether altruistic in planning for the education of young men to carry on the industry in the future. Education should be systematic above everything else and the best method in his opinion is a combination of technical with practical training in the shops. Teaching is a fine art and men who work part of the time in the shops cannot achieve the results in teaching young men that instructors devoting all their time to the work are able to do.

Spencer Miller suggested the need of a closer cooperation between technical schools and our industrial establishments. The details of Mr. Bailey's scholarship classifications (a), (b), (c) and (d) provide a systematic way in which the varying demands of the apprentice group may be wisely met.

Professor H. A. Everett outlined the plan carried out by the Union Shipbuilding Company of taking young men soon after graduating from technical schools and putting them through a two years' course of training in all parts of the organization and then using those able to qualify in minor executive positions and the like. A closer relation between technical institutions and industries should be fostered. The colleges will always be found ready to cooperate in any way possible.

Benjamin G. Fernald seemed to think that the technical college had brought about a condition which was not for the ultimate good of industry, by dividing the man power into groups, one for the actual work, and the other to superintend and carry on the executive details—the latter being college trained men without practical experience.

Mr. Fernald was quite in sympathy with the plan referred to in the paper, the only suggestion offered being that those putting the plan into effect guard against losing sight of the fundamental purpose, that of making competent workmen. The educational features are in the nature of a reward for effort on the part of the apprentice beyond that merely necessary to secure his certificate. With such a system little if any preference should be shown to technical graduates.

Professor L. B. Chapman, speaking on behalf of the universities, declared that the colleges were only too glad to cooperate with the industries in training men. The finest types of young men who come to the technical schools for education are those who have had practical experience in an industry and have a definite desire to study with the object of returning to that industry.

At Lehigh University the present senior class in naval architecture has had at least eight weeks training in shipyards and eight weeks at sea. This combination of experience is the best foundation for the training of these men in the art of shipbuilding.

H. P. Frear agreed with the method of training apprentices and establishing scholarships as outlined in Mr. Bailey's paper.

W. W. Smith also agreed with the points taken up in the paper and seemed to think that the training of personnel should be an official responsibility and function of every company.

H. C. Towle felt that students should be made to look upon their college training as a background on which to develop their positions in industry.

C. T. Coler declared that we are not awakening to the need of industrial education any too soon. Work should be the backbone of such training and should be dignified in the school, in the home and in the industry. He outlined the experience of the Westinghouse Electric & Manufacturing Company, which has been successful in training apprentices and technical men.

The future progress in industrial training lies in a quality rather than a quantity standard—fewer men, better trained.

Maxwell W. Day, in outlining the methods used by the General Electric Company, stated that this company does not attempt to maintain a definite ratio of apprentices to journeymen in any trade. At all the large plants of the company well equipped apprentice training rooms are maintained, where young men begin their work under the supervision of qualified instructors.

Mr. Day approved of the scholarship feature of Mr. Bailey's plan.

In addition to the apprentice course, the General Electric Company has a student engineering course for graduates of technical schools selected by a representative of the company who visits the various technical colleges each year.

L. C. Brooks explained the system of cooperation existing between the Lynn shops of the General Electric Company and the Massachusetts Institute of Technology. A great field for similar arrangements is open between educational institutions and the industries.

Walter M. McFarland pointed out that it was not advisable to make higher education too easy, that it must be worked hard for to be of real value. As has been stated by one famous educator, higher education too lightly considered has spoiled a great many good mechanics and clerks by making poor engineers and business men.

He also outlined the system of entrance to Webb Academy and offered the facilities of this institution to the sons of men in the various shipyards who showed special interest and aptitude in shipbuilding.

John H. McAlpine outlined the early systems of training apprentices in Great Britain. The opening of schools in the works as is now common in this country was a great advance. These works schools are not intended to replace institutions of higher learning and could not possibly do so.

Cooperative plans of training are excellent as typified by the arrangement between the Massachusetts Institute of Technology and the General Electric Company at Lynn. This system is similar to the Cincinnati plan originated fifteen years ago, in which "every student of the University during his course is required to work four terms of three months each in some of the engineering industries of the Pittsburgh district." While in the works the students are kept under the observation of their professors.

William L. Cathcart seemed to think that the system suggested by Mr. Bailey would attract a fine class of young men to the industry.

Peabody-Fisher Oil Burners

THE Peabody Engineering Corporation, New York, demonstrated a new wide range mechanical fuel oil burner at the Exposition. By means of this burner the steam pressure in a vessel's boilers can be controlled by regulating the amount of oil atomized by the burners. This burner delivers oil at a high centrifugal speed through a tip orifice on the general principle of other mechanical atomizers and it also has a return feature of atomizing any quantity of oil from its designed capacity to 12 percent of this amount.

Diffusers made of a special heat resisting alloy are fitted to each burner instead of the old type of cast iron diffusers.

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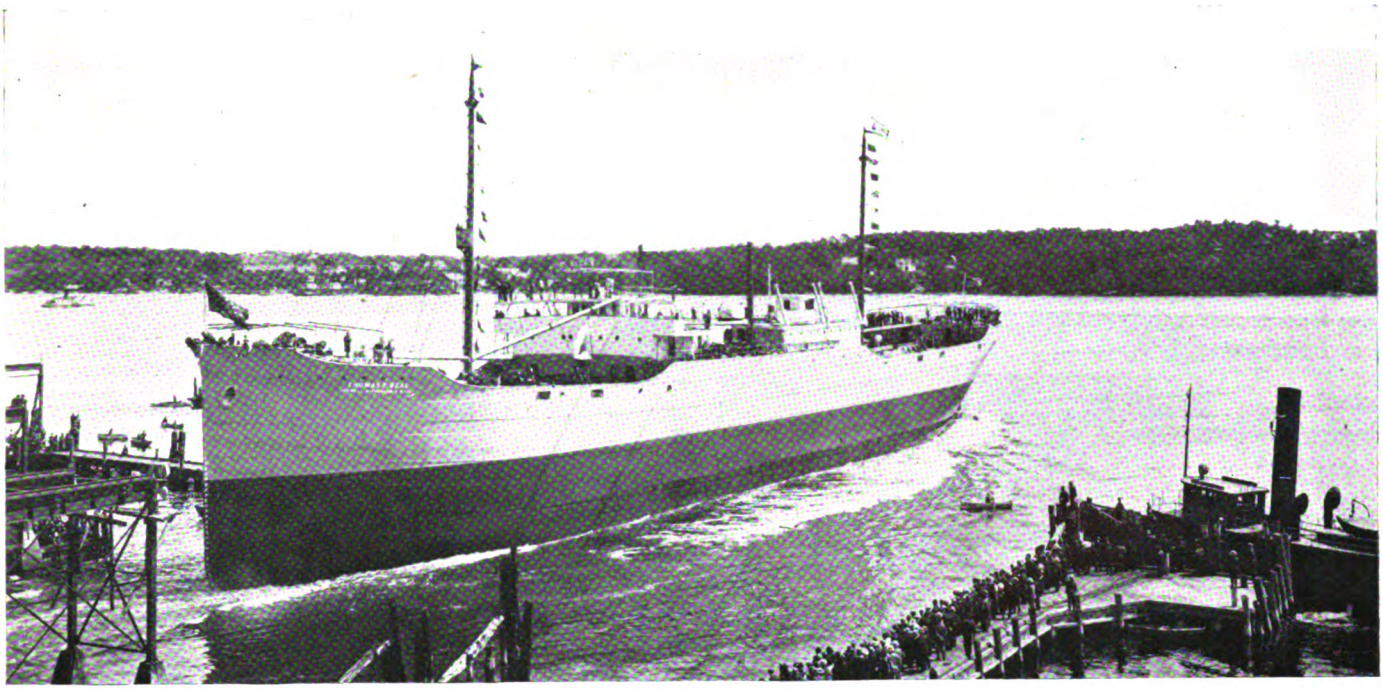
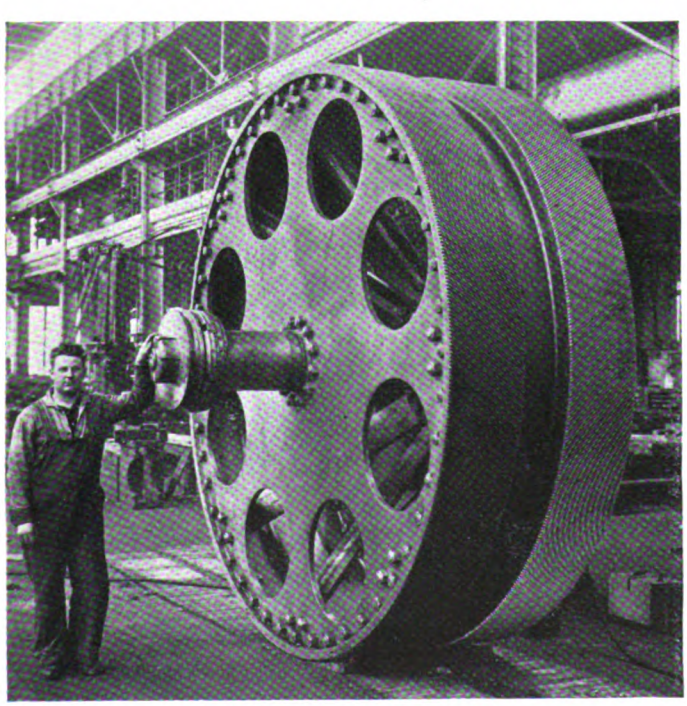


Launching of S. S. Thomas P. Beal at the Bath Iron Works

Modern Steam-Driven Freighter Thomas P. Beal

9,600 Deadweight Ton Vessel Designed for General Freight Service, Propelled Through Single Reduction Gears by Parsons Turbines

ONE of the most persistent criticisms of the large fleet of merchant vessels constructed by the Government during the war has been that the vessels were built primarily for war needs and were not of a type suitable for economical operation in normal peace times. That this criticism is taken seriously in some quarters is evidenced by the fact that while approximately 1,000 Shipping Board vessels are lying idle the construction of a number of new merchant ships is being carried on throughout the nation. The *Thomas P. Beal,* which has just been completed at the plant of the Bath Iron Works, Ltd., Bath, Me., for the Crowell & Thurlow Steamship Company, Boston, Mass., represents a modern post-war type of vessel for general freight service.



Main Gear Wheel Ready for Installation

This latest addition to the Crowell & Thurlow Steamship Company's fleet is 395 feet 6 inches long between perpendiculars, 55 feet beam and 34 feet 6 inches molded depth. It is in general a sister ship of the *A. L. Kent,* built by the same company last year for Messrs. Crowell & Thurlow, except that its main propelling machinery consists of geared steam turbines instead of reciprocating engines as in the *Kent.* This change has enabled the machinery space to be shortened one frame space, while still obtaining the maximum tonnage deduction for propelling machinery, and in this way the cubic capacity has been increased by 3,250 cubic feet. It has also been found possible to increase the deadweight tonnage approximately 50 tons so that this vessel represents a considerable advance over its sister ship. The fuel consumption also has been decreased as compared with the *Kent* by the use of geared turbine machinery.

Hull

The *Thomas P. Beal* is a vessel of the poop, bridge and forecastle type with machinery amidships and one funnel and two pole masts. It was built under special survey of the American Bureau of Shipping to class ✠A.1. E, the construction and equipment being also in accordance with the rules of the United States Steamboat Inspection Service.

The vessel is built on the transverse framing system with a straight stem and semi-elliptical stern and has a short poop 40 feet long, a bridge 116 feet long extending over the engine

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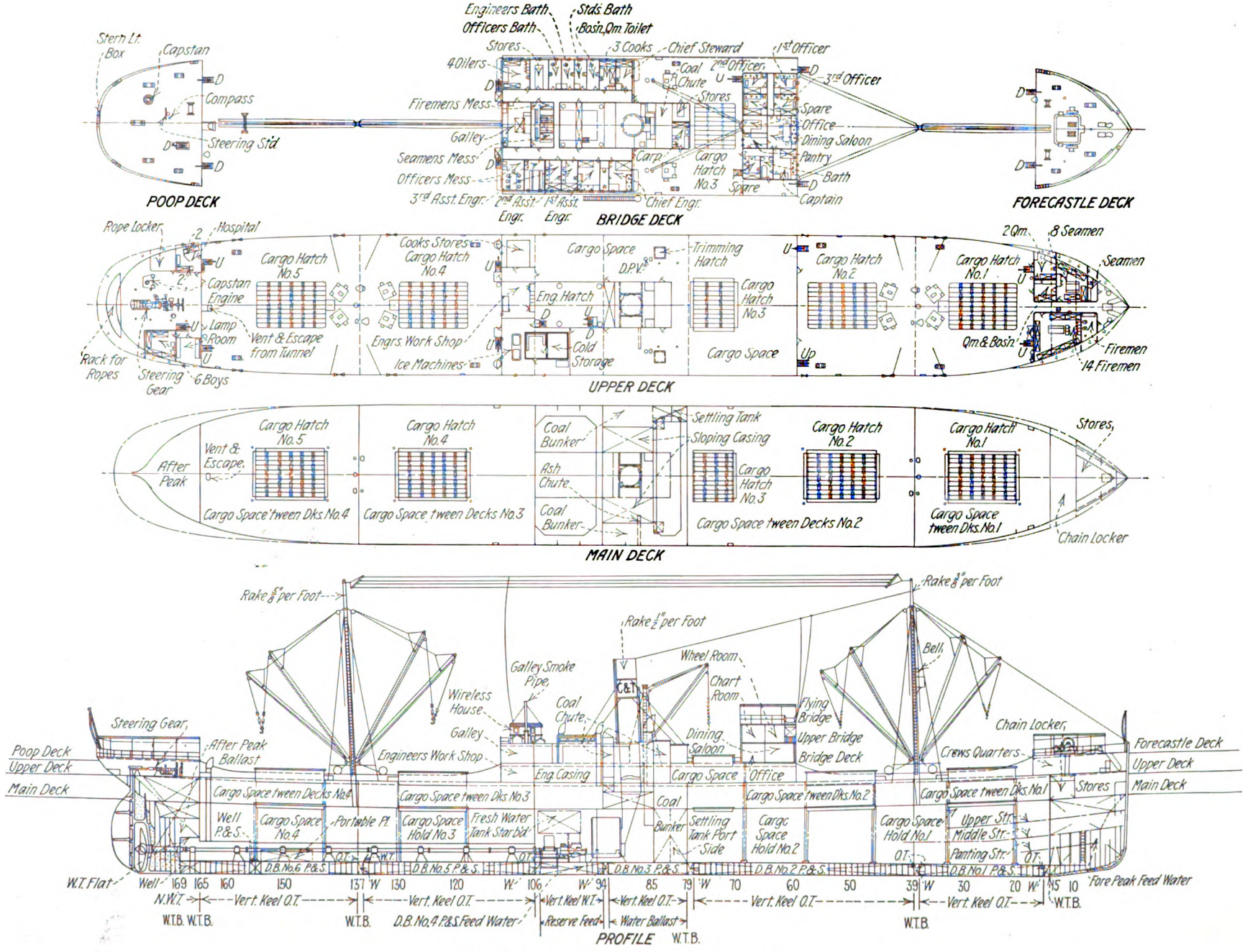

S. S. Thomas P. Beal: Profile and Deck Plans

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Modern Steam-Driven Freighter Thomas P. Beal

General Information

Service: General Freight.

Builder: Bath Iron Works, Ltd., Bath, Maine.

Owner: Crowell & Thurlow Steamship Co., Inc., Boston, Mass.

Characteristics

Length, overall	410′ 6″
Length, B. P.	395′ 6″
Breadth, molded	55′ 0″
Depth, molded	34′ 6″
Draft, loaded	27′ 1″
Draft, light	8′ 4″
Block coefficient	0.78
Midship section coefficient	0.99
Longitudinal coefficient	0.79
Speed, loaded, knots	10
Cruising radius, nautical miles	11,000 (oil)
Framing	transverse

Class ✠ A - 1E American Bureau of Shipping.

Tonnages

(In tons of 2,240 pounds)

*Weight of Hull	3,048
**Weight Propelling Machinery	465
Deadweight Capacity	9,600
Displacement	13,113

(In tons of 100 cubic feet)

Gross register	6,216
Net register	4,509

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment, and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Canal Ratings

(In tons of 100 cubic feet)

	Gross	Net
Suez		
Panama		

Equipment

2 Bower anchors, stockless, each	7,140 lbs.
1 Bower anchor, stockless	6,104 lbs.
1 Stream anchor, ex-stock	2,450 lbs.
1 Kedge anchor, ex-stock	1,050 lbs.
Chain, cable, 2¼″ stud	270 fms.
Towline, 4½″ circ. steel wire	120 fms.
Streamline, 4¼″ circ. steel wire	90 fms.
Hawser, 8″ circ. manila	180 fms.
Hawser, 7″ circ. manila	180 fms.

Rudder

Area, square feet	157
Dia. Stock, inches	10.5
C. Press, abaft C. L. pintles	3′ 3″

Complement

Deck officers	5
Deck crew	13
Engineer officers	4
Engineer crew	12
Purser's and steward's department	4
Total officers and crew	38
First-class passengers	
Second-class passengers	
Third-class passengers	
Total passengers	
Total complement	

Handling Equipment

	No.	Type	Capacity	Length
Masts	2	Pole	.....	.....
Derrick posts	2	....	.....	.....
Brooms	5	Wood	5-ton	40′ 0″
Brooms	8	Wood	5-ton	50′ 0″ to 57′ 0″

Deck Machinery

Steering Gear	Hyde screw gear 9″ × 9″
Windlass (1)	Hyde, 10″ × 14″ horiz.
Capstans (1)	Hyde 8″ × 8″
Winches (10),	Mead Morrison 7″ × 10″, single geared

Life Saving Equipment

	No.	Capacity	Length
Life boats	4	25 persons	22′ 6″
Work boat	1		16′ 0″

Propelling Machinery

Boilers

Number	3
Type	Single ended Scotch
Length	11′ 6″
Diameter	15′ 9″
Furnaces, each boiler	4
Fuel	coal or oil
Draft	natural
Total heating surface, square feet	8,250
Total gate surface, square feet	240
Superheat, degrees F.	none
Working pressure, lbs. per sq. in.	180
Normal fuel consumption:	
Per day, tons,	coal 36, oil 25
Per shaft horsepower hour pounds	coal 1.65, oil 1.15
Normal steam production:	
Per hour per pound of fuel	lbs.
Total per hour	30,000 lbs.

Engines

Number	(1) H. P. — (1) L. P.
Type	Parsons turbines
Size	1,100 nominal H. P. each
Horsepower, total shaft	2,200

Propellers

Number	1
Type	4 bladed, built up
Weight	26,000 lbs.
Diameter	17′ 3″
Pitch	16′ 6″
R. P. M.	75
Projected area, sq. ft.	85
Developed area, sq. ft.	95

Auxiliary Machinery

Machinery Space

Condenser, (1) main, 2,758 sq. ft. cooling surface.

Condenser, aux. (1) 1,000 sq. ft. cooling surface.

Evaporator, (1)	Reilly-Goodgall
Distiller	
Filters	
Feed water heater, (1)	Reilly
Fuel oil heaters, (2)	Dahl

Pumps

(1) Main air twin beam... 10 × 22 × 15
(2) Main feed, vert. simplex... 12×8×18
(1) Donkey feed, vert. duplex... 10×7×10
(1) Fire & bilge, hor. duplex 10×8½×12
(1) Aux. air & circ., hor. simplex 10 × 12 × 12 × 12
(1) Evap. feed, vert. simplex.. 3½×4×4
(1) Fresh water, vert. simplex.. 3½×4×4
(2) Lub. oil vert. simplex..... 6×7×12
(1) Ballast, hor. duplex ..... 12×14×12
(2) F. O. Service, hor. duplex 5¼ × 3½ × 5
(1) F. O. Transfer, hor. duplex 6 × 5¾ × 6
(1) Amm. cond. circ., hor. duplex 5¼ × 3½ × 5

Refrigerating Machinery

(2) 1-ton Brunswick machines

Electric Equipment

Generator, (1)	15 K. W., General Electric
Radio,	2 K. W. Simon
Emergency	none

Holds

No.	Length	Hatches
1	54′ 0″	18′ × 27′
2	89′ 0″	18′ × 27′ / 18′ × 15′ 9″
3	67′ 6″	18′ × 27′
4	56′ 0″	18′ × 27′

Capacities

Cargo Space

Compartment	Cu. ft.
Hold, No. 1	54,162
" No. 2	99,367
" No. 3	72,157
" No. 4	48,987
'Tween dk. No. 1	24,390
" " No. 2	45,020
" " No. 3	35,362
" " No. 4	30,030
Bridge	30,632

Refrigerated Space

Compartment	Cu. Ft.
Ship's cold storage	1,120

Coal Bunkers

Compartment	Cu. Ft.	*Bbls.	*Tons
Cross bunker	22,596	.....	538
Hanging bunker	7,155	.....	170.3
Reserve bridge	34,138	.....	812.8
Total	63,889	.....	1,521.1

Oil Bunkers

Dbl. bot. tank No. 1.	7,310	1,302.1	.....
" " " " 2.	20,704	3,697.5	.....
" " " " 5.	14,480	2,579.0	.....
" " " " 6.	4,374	779.3	.....
Settling tanks	1,500	267.2	.....
Total	48,368	8,615.1	

*42 cu. ft. per ton; 42 gals. per bbl.

Tanks

Compartment	Cu. Ft.	Tons F. W.	Tons S. W.
Fore peak	11,081	307.8	.....
Dbl. bot. tank No. 1.	7,310	.....	208.9
" " " " 2.	20,704	.....	591.5
" " " " 3.	7,422	.....	212
" " " " 4.	5,634	156.5	.....
" " " " 5.	14,480	.....	413.7
" " " " 6.	4,374	.....	125
After peak	11,662	.....	333.2
Total	82,667	464.3	1,884.3

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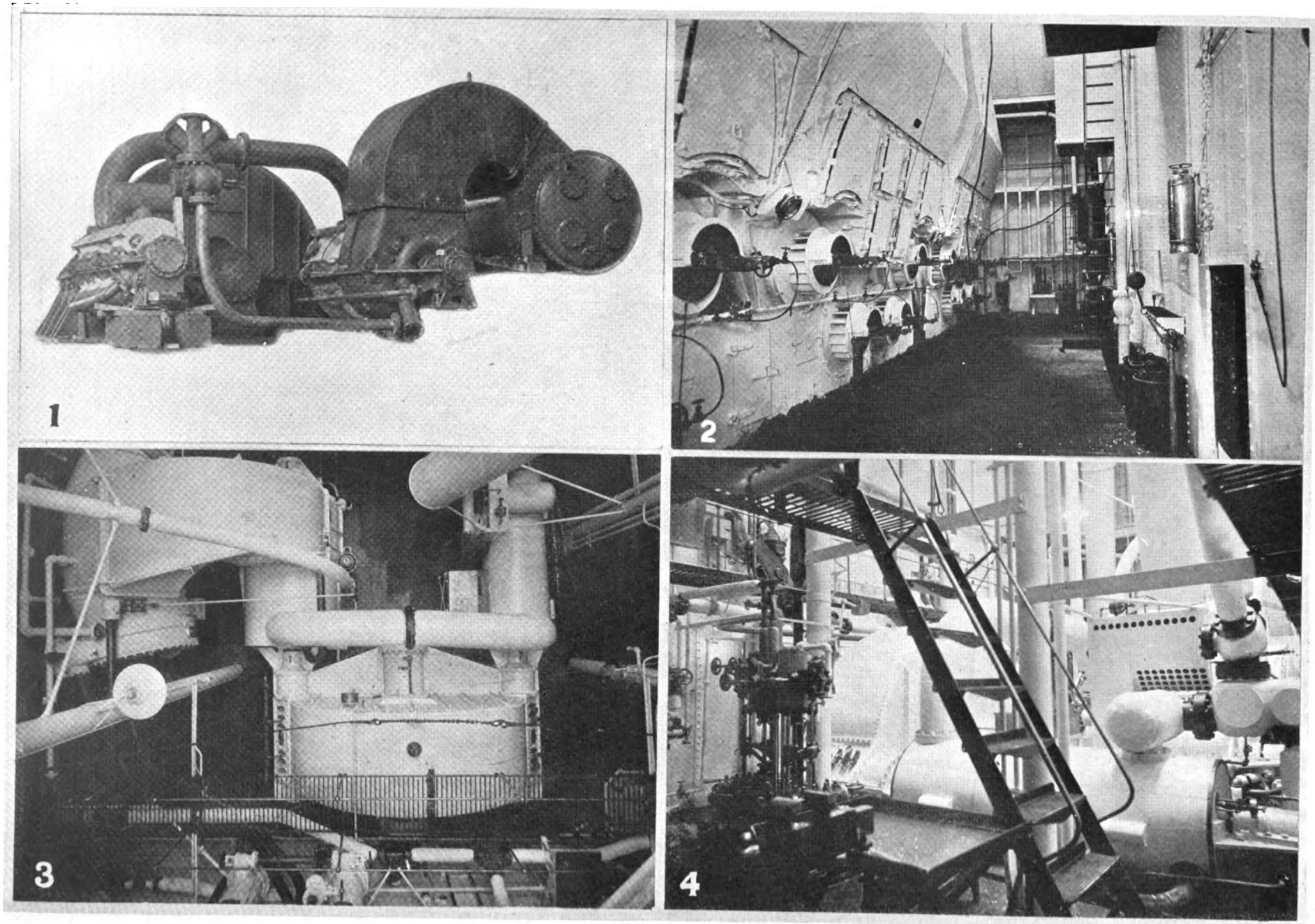

Machinery of S. S. Thomas P. Beal: (1) Turbines, Gear and Condenser Erected in Shop. (2) View of Boiler Room. (3) View of Engine Room, Looking Down from Upper Grating. (4) View of Engine Room Looking to Port.

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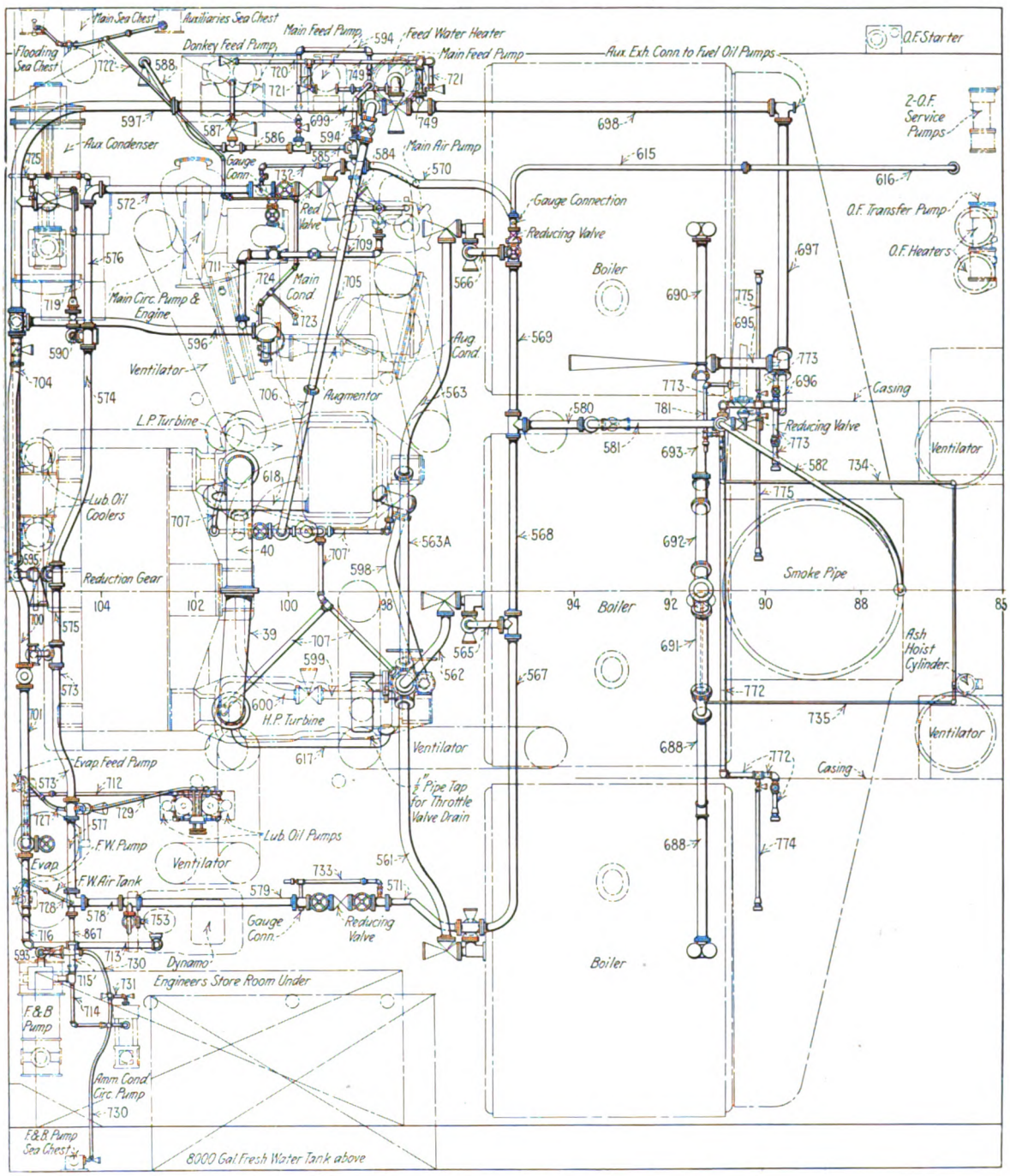
and boiler casings and a forecastle 38 feet long. Six steel watertight transverse bulkheads are fitted. A cellular double bottom extends the entire length between the peak bulkheads and is fitted for the carriage of either fuel oil or water ballast, except the space under the engine room which is used for reserve feed water. Deep settling tanks are built on the port side of the cross bunker extending from the tank top to the main deck. The fore peak is fitted for fresh water and the after peak as a ballast tank.

The large fuel oil capacity given provides a cruising radius of about 11,000 miles at 10 knots loaded. If it is desired at any time to use coal as fuel, the bridge space, wing bunkers and cross bunker and also the after end of No. 2 hold can all be utilized for bunkers without any structural alterations.

Two steel deck houses are built on the bridge, the forward one containing the captain's and navigating officers' quarters and forming a support for the wooden charthouse above, while the after one encloses the engine and boiler casings and contains the engineers' quarters, galley, etc. The crew is housed in the forecastle and the poop contains the hospital, lamp room and steward's room.

The vessel is equipped with four 22-foot 6-inch metal lifeboats on the after deck house and one 16-foot wooden boat on the starboard side of the upper bridge.



Plan of Machinery Space

CARGO SPACE

The under deck space has been divided into four main cargo holds, each with 'tween deck space above the main deck. In No. 2 hold provision has been made for fitting a wooden bulkhead near the after end to form an extra reserve bunker if found necessary.

CARGO HANDLING GEAR AND DECK AUXILIARIES

Four 5-ton Oregon pine booms are provided at each mast and one 5-ton boom at each king post on the bridge deck.

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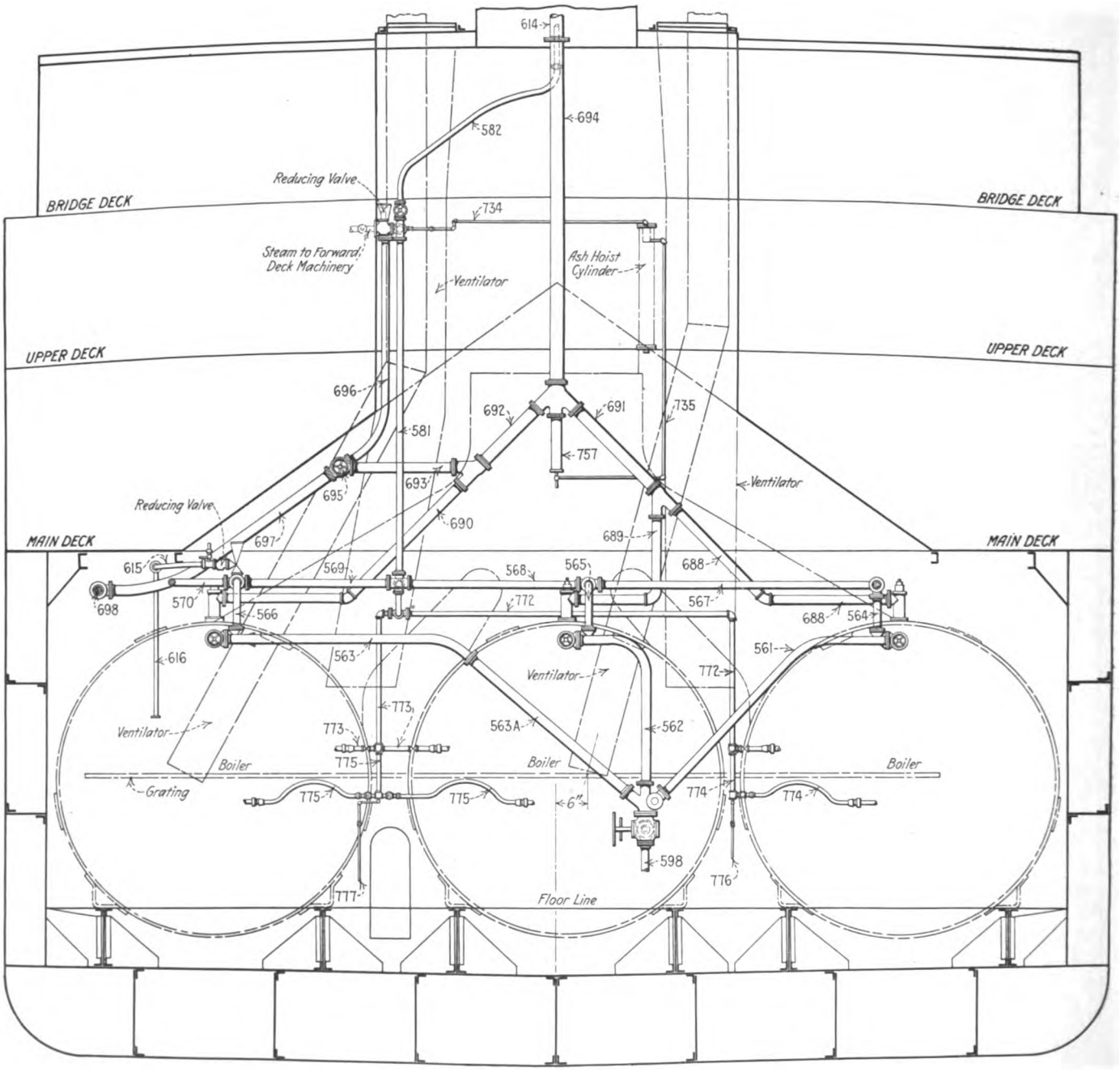
LIST OF PIPES COMPRISING THE STEAM AND EXHAUST SYSTEM

Mark	Nominal Size, Inches	Material	Test Press., Lbs.	Service
39	14	Copper	50	L. P. turbine receiver pipe.
40	14	Copper	50	L. P. turbine receiver pipe.
343	3	Copper	360	Steam to aft deck mach. and smothn'g manifold.
344	3	Copper	360	Steam to aft deck machinery.
345	2	Copper	360	Steam to aft deck machinery.
561	4½	Copper	360	Main steam starboard boiler.
562	4½	Copper	360	Main steam center boiler.
563	4½	Copper	360	Main steam port boiler.
563A	4½	Copper	360	Main steam port boiler.
564	3½	Copper	360	Aux. steam starboard boiler.
565	3½	Copper	360	Aux. steam center boiler.
566	3½	Copper	360	Aux. steam port boiler.
567	3½	Copper	360	Aux. steam between starboard and center boilers.
568	3½	Copper	360	Aux. steam center to port.
569	3½	Copper	360	Aux. steam center to port.
570	3½	Copper	360	Aux. steam port side.
571	3½	Copper	360	Aux. steam starboard side.
572	3½	Copper	360	Aux. steam port.
573	3½	Copper	360	Aux. steam aft port side.
574	3½	Copper	360	Aux. steam aft port side.
575	3½	Copper	360	Aux. steam aft starboard side.
576	3½	Copper	360	Aux. steam aft starboard side.
577	3½	Copper	360	Aux. steam aft starboard side.
578	3½	Copper	360	Aux. steam starboard side.
579	3½	Copper	360	Aux. steam starboard side.
580	3	Copper	360	Aux. steam to forward deck mach. and soot blowers.
581	3	Copper	360	Aux. steam to forward deck mach. and whistle.
582	2	Copper	360	Steam to whistle.
583	2	Copper	360	Steam to soot blowers.
584	2	Copper	360	Steam to main air pump.
585	2½	Copper	360	Steam to feed pumps and injector.
586	2	Copper	360	Steam to donkey feed and injector.
587	2	Copper	360	Steam to donkey feed pump.
588	2	Copper	360	Steam to injector.
589	2	Copper	360	Steam to main circ. pump.
590	2½	Copper	360	Steam to ballast pump.
591	2	Copper	360	Steam to evaporator.
592	2	Copper	360	Steam to dynamos.
593	2	Copper	360	Steam to fire and bilge pump.
594	1½	Brass	...	Steam to feed pumps.
595	3	Copper	360	Steam to steering engine.
596	4	Copper	50	Aux. exhaust to main condenser.
597	5	Copper	50	Aux. exhaust port side.
598	4½	Copper	360	Backing steam.
599	4	Copper	360	Emergency steam to L. P. ahead.



S. S. Thomas P. Beal—Section in Way of Boilers, Looking Forward

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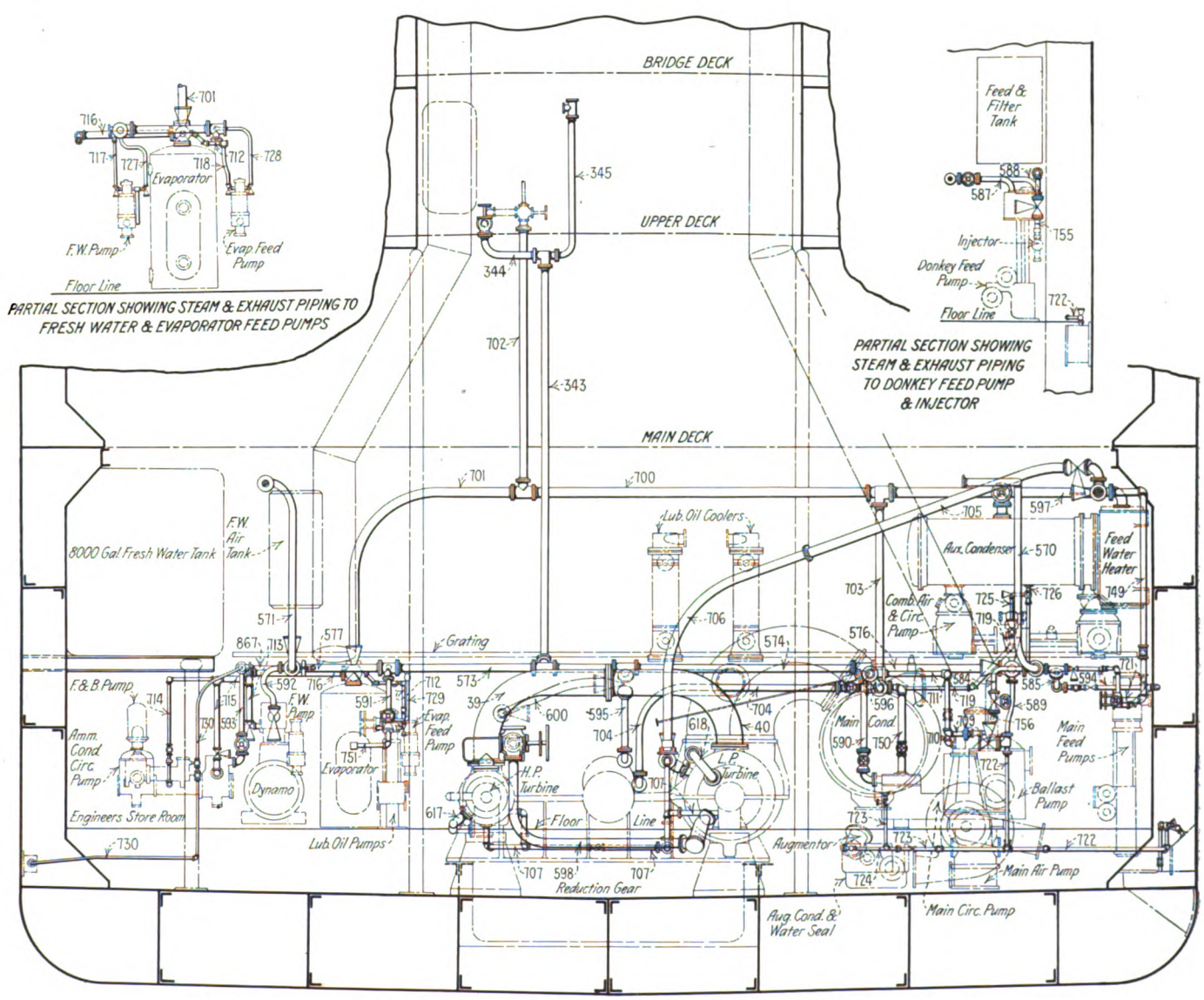
Mark	Nominal Size, Inches	Material	Test Press., Lbs.	Service
600	4	Copper	360	Emergency steam to L. P. ahead.
614	7½	Copper	...	Escape pipe above house.
615	2	Copper	360	Steam to fuel oil system.
616	2	Copper	360	Steam to fuel oil system.
617	4	Copper	30	Equalizer pipe H. P. turbine.
618	4½	Copper	30	Equalizer pipe L. P. turbine.
688	4½	Steel	...	Escape pipe from starboard boiler.
689	4½	Steel	...	Escape pipe from center boiler.
690	4½	Steel	...	Escape pipe from port boiler.
691	6	Steel	...	Escape pipe from starboard and center boiler.
692	6	Steel	...	Escape pipe, port and aux. exh. to atmosphere.
693	5	Steel	...	Aux. exhaust to atmosphere.
694	8	Steel	...	Escape pipe.
695	5	Steel	...	Aux. exhaust to atmosphere.
696	4	Steel	...	Aux. exhaust from forward deck machinery.
697	5	Steel	...	Aux. exhaust from forward deck machinery.
698	5	Steel	...	Aux. exhaust from forward deck machinery.
699	5	Steel	...	Aux. exhaust in engine room, port.
700	4½	Steel	...	Aux. exhaust in engine room, aft.
701	4½	Steel	...	Aux. exhaust in engine room drop to evaporator.
702	3½	Steel	...	Aux. exhaust from aft deck machine bulkhead No. 106.
703	4	Steel	...	Aux. exhaust to main cond. and from steering engine.
704	3	Steel	...	Aux. exhaust from steering engine.
705	4	Steel	...	Auxiliary exhaust to L. P. receiver.
706	4	Steel	...	Auxiliary exhaust to L. P. receiver.
707	2	Steel	...	Gland steam piping.
708	5	Steel	...	Aux. exhaust to aux. condenser.
709	2½	Steel	...	Exhaust from main air pump.
710	2½	Steel	...	Exhaust from main circ. pump.
711	3½	Steel	...	Exhaust from main air and circ. pump.
712	1¼	Steel	...	Exhaust from lubricating oil pumps.
713	2½	Steel	...	Exhaust from dynamo.
714	1¼	Steel	...	Exhaust from ammonia cond. circ. pump.
715	2½	Steel	...	Exhaust from fire and bilge pump.
716	3½	Steel	...	Exhaust from fire and bilge pump and dynamo.
717	½	Steel	...	Exhaust from fresh water pump.
718	½	Steel	...	Exhaust from evap. feed pump.
719	2	Steel	...	Exhaust from comb. air and circ. pump.
720	2½	Steel	...	Exhaust from donkey feed pump.
721	2	Steel	...	Exhaust from main feed pumps.
722	1	Brass	...	Steam to port sea chests.
723	1	Brass	...	Steam to main condenser boiling out.
724	¾	Brass	...	Steam to augmentor.
725	1¼	Brass	...	Steam to combination air and circ. pump.
726	1	Brass	...	Steam to aux. condenser boiling out.
727	⅜	Brass	...	Steam to fresh water pump.
728	⅜	Brass	...	Steam to evap. feed pump.
729	1	Brass	...	Steam to lubrication oil pumps.
730	1	Brass	...	Steam to ammonia cond. circ., pump and sea chest.
731	¾	Brass	...	Steam to ammonia cond. circ. pump.
732	1	Brass	...	By-pass reducing valve, starboard side.
733	1	Brass	...	By-pass reducing valve, port.
734	½	Brass	...	Steam to ash hoist cylinder.
735	¾	Steel	...	Exhaust from ash hoist cylinder.
749	3	Steel	...	Exhaust from feed pumps to aux. exhaust line.
750	3	Steel	...	Exhaust from ballast pump.
751	2	Brass	...	Steam to evaporator.
752	2	Copper	...	Steam to F. and B. and ammonia cond. circ. pump.
753	2	Brass	...	Steam to dynamo.
754	1	Brass	...	Red. valve, by-pass steam to forward deck machinery.
755	2	Brass	...	Steam to injector.
756	2	Brass	...	Steam to main air pump.
757	6	Steel	...	Escape pipe drain.
781	1	Brass	...	By-pass reducing valve, steam to forward mach.
772	2	Steel	...	Steam to soot blowers, starboard boiler.
773	2	Steel	...	Steam to soot blowers, port and center boilers.
774	1¼	Steel	...	Steam to soot blower, starboard boiler.
775	1¼	Steel	...	Steam to soot blowers, port and center boilers.
776	⅜	Steel	...	Drain from steam to soot blower, starboard boiler.
777	⅜	Steel	...	Drain from steam to soot blowers, port and center boilers.
867	2	Copper	...	Steam to F. and B. and ammonia cond. circ. pumps.



Section Through Engine Room, Looking Aft

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The cargo hoists are handled by 7-inch by 10-inch single-geared winches, one to each boom.

A windlass is provided on the forecastle and a warping capstan on the poop.

Steam steering gear is installed in the poop, controlled by telemotor from the pilot house.

Large cargo hatches 18 feet by 27 feet are provided in both the upper and main deck to each cargo hold and in addition a hatch 18 feet by 15 feet 9 inches is provided to the bridge space and the after end of number 2 hold. Trimming hatches are fitted in the bridge space so that this may be used as a reserve bunker if so desired.

Main Propelling Machinery

The propelling machinery is a geared steam turbine drive of about 2,200 maximum shaft horsepower, designed and built by the Bath Iron Works. It consists of one high pressure and one low pressure turbine driving a single reduction gear coupled to a single screw.

The steam is supplied by three Scotch boilers using natural draft and equipped to burn either coal or oil fuel.

The main turbines are of the Parsons type designed for about equal power, i. e., 1,100 shaft horsepower each, and run at about 1,600 revolutions at full power.

The high pressure turbine is designed to take steam at 170 pounds and expand it, through 64 rows of blades, arranged in eight expansions and three rotor steps, to about atmospheric pressure in the receiver.

The low pressure turbine takes steam at atmospheric pressure and exhausts to the condenser. There are twenty rows of blades in the low pressure ahead turbine and twenty-one rows in the astern turbine, which is incorporated in the low pressure turbine casing. The low pressure blading is especially designed to enable the turbine to take advantage of high vacuum.

Dummies, the diameters of which are calculated to balance automatically all steam thrust under full power conditions, are fitted to all turbines and any small unbalanced thrust or axial adjustment is provided for in the Kingsbury thrust bearings fitted at the forward end of each turbine.

A flexible coupling is fitted between the turbine rotor and pinions to permit the independent axial adjustment of either.

The high pressure rotor is a solid forging, and the low pressure rotor is of hollow drum construction with the spindle ends in separate forgings.

By special care in the design of the turbines the drainage is automatic except for one small pocket, for which a hand drain had to be provided and which is so small that should it be forgotten during operation it is not likely to cause any damage.

Similarly the sealing of the glands is controlled entirely by one valve, a specially designed automatic one, and experience showed on the trials that this required no attention at all.

Provision is made for putting any excess auxiliary exhaust that may be available into the low pressure receiver or to draw therefrom in case there is a deficiency of steam in the feed water heater.

A single reduction gear is employed to transmit the power from the turbines to the main shaft and at the same time reduce the revolutions from 1,600 at the turbines to 75 on the shaft. The main gear is 130 inches in diameter and has a total width of face of 32 inches. The pinions are 6.25 inches pitch circle diameter and the tooth pressure at full power is about 375 pounds per inch of face, a very conservative value for the load on the teeth.

In connection with the installation of single gearing it is interesting to note that in order to reduce the amount of shaft tunnel space and so give maximum cubic capacity, the center keel and tank top have been cut to form a recess for the gear box, thus bringing the shaft as low as possible.

A feature of the design of the gear box is the lower casing, which was made larger than usual in order to form the oil drain tank for the whole lubrication system. An automatic float control is arranged to keep the level of oil in gear box within reasonable limits and to insure proper circulation in the system.

The gear wheel is built up of forgings and heavy plates. The rim was supplied, and the teeth cut, by the Parsons Company and assembled and completed by the Bath Iron Works. This design of wheel is very light when compared with the usual type, having a cast iron or cast steel center, the light design being advantageous in this case because the reduction in mass moment of inertia has the effect of increasing the natural frequency of torsional vibration of the shaft, thus augmenting the difference between this frequency and the normal full power revolutions and reducing the range of variation of stress in the shaft.

The teeth are of the herringbone type, cut on the creep principle 0.677 inch circular pitch and about 30 degrees helical angle.

The entire propeller thrust is taken by a 21-inch Kingsbury bearing fitted to the forward end of the gear shaft.

Forced lubrication is provided to all turbine, gear and thrust bearings. The system is a gravity one and includes the usual pumps, strainer, tanks and coolers, all in duplicate.

Steam to the lubricating oil pumps is controlled by a chronometer valve actuated by a float in the pan of the gear box, which forms the drain tank for the system, and the level of the oil therein is kept within two or three inches of the desired level. The pumps discharge through strainers to the coolers and thence to the supply tanks located high up in the engine room casing.

Supply pipes lead from the tanks to the bearings.

Automatic telltales mounted on the handling platform show the level of oil in the supply tanks and an automatic steam whistle alarm is fitted to give warning of a fall in oil pressure at the bearings.

A condenser having 2,750 square feet of cooling surface is installed, specially designed to provide the high vacuum of which the turbines can take advantage. The tubes are ¾ inch diameter and are expanded into the tube sheets.

A vacuum augmentor is installed to assist the twin beam vertical air pump to maintain the high vacuum obtained on the trial, viz., 28.5 inches at the top of condenser at full power, measured by the absolute mercury column.

Boilers

Steam is generated in three Scotch boilers 15 feet 9 inches diameter and 11 feet 6 inches long, designed for a working pressure of 180 pounds per square inch. Each boiler has four furnaces and separate combustion chambers to each furnace. The vessel as delivered was equipped for oil burning with a Dahl system, but carries on board a full set of furnace fronts, grates and bearers for coal burning, which can be installed in a few hours.

The coal bunkers can be used for cargo when coal is not being carried, oil fuel being stowed in the double bottoms.

The vessel has a cruising radius of 11,000 miles on oil and 4,700 miles on coal, using permanent bunkers only.

Consumptions

Water measurements were not made on the trial of the vessel but based on calculations checked by numerous trials conducted by the same builders when water was measured. The steam consumption at full power is about 11.8 pounds per shaft horsepower for turbines only, which is about 18 percent less than that of a reciprocating engine of equal power.

The coal consumption at 10 knots will be about 36 tons per day and the oil 25 tons or 163 barrels a day.

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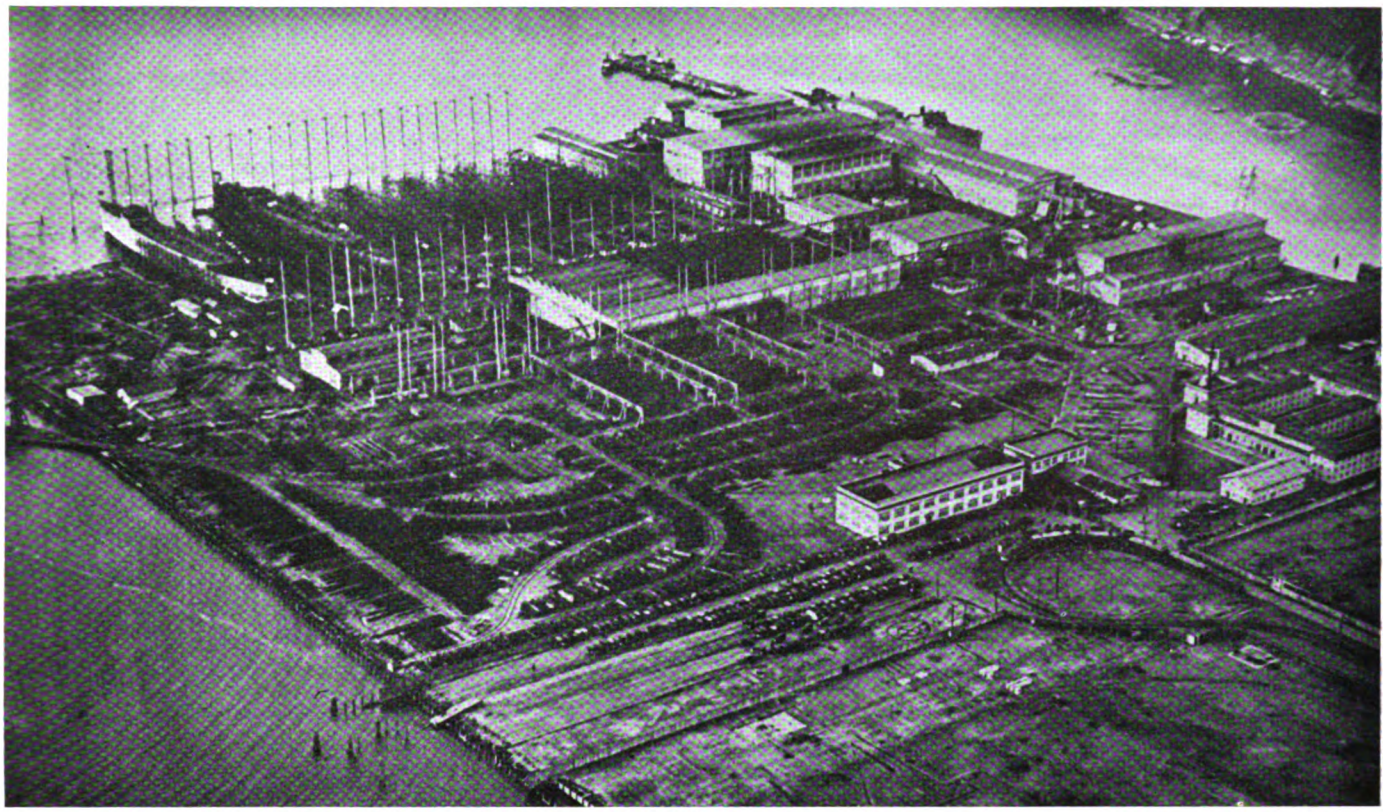

View of Todd Tacoma Plant from Airplane

Todd Corporation's Model Shipyard at Tacoma

Plant Specially Designed and Arranged for Economical Handling of Materials—Has Connections with Four Trans-Continental Railroads

THE lull in shipbuilding activities during the inevitable reconstruction period following the war has created a competition among the shipyards which is so strong that only those most modern in type are able to stay in the game and secure enough work to pay expenses.

During the war, when the vital need of the allied governments was ships and more ships, any means for producing these necessary vessels were encouraged until the list of shipyards in the United States swelled to proportions never before equaled in the history of the nation. With the ability of any type yard to secure all the work it could handle at the prevailing, excessive, war-time prices, many of those who undertook to establish shipyards did not prepare for the lean period which was bound to follow the war, or, in trying to do so, were handicapped by the scarcity of trained men in the profession whose advice is so essential. The result was that when the first blow came many closed their doors and retired from the business.

The Todd Dry Dock & Construction Corporation's plant at Tacoma, Wash., is one of the new yards which was planned with forethought and is representative of the modern trend in efficient shipyard operation.

The actual yard area comprises about 65 acres of filled land inside of bulkheads, having deep water on three sides of it and providing a waterfront of 1¼ miles. Twenty-five acres of filled area are paved for working spaces and roadways and there are 16 acres of floor space in the shops. Wharfage space, totaling 1,800 feet, is provided on the east side for outfitting purposes.

The entire arrangement of shops and buildings was conceived with the idea of straight line progress of material from receipt at the yard to installation aboard a vessel. Ample railroad facilities connect the yard to four trans-continental roads and the various shops are inter-connected with three miles of track. In addition to this, there are 1¼ miles of crane ways within the buildings which provide for the handling of all material by efficient machinery at a saving in time and labor.

Facilities for handling structural material from the shops to the ways is provided for by aerial cableways, three of which extend over each of the eight ways. In all there are about 2 miles of such cableways and these extend not only over the vessels on the ways but cover the assembly space between the ways and the fabricating shop, thus providing an easy means of erecting, fabricating and assembling material.

Power Plant

The power for operating the mechanical equipment of the entire yard is generated and controlled in a power house of thoroughly modern design. Electric power for operating the machinery is distributed under ground through six miles of lead-covered cable in concrete conduits. Control power for all shops is obtained from a switchboard in the power house. There are also located in the power house seven Ingersoll-Rand compressors of 2,100 cubic feet capacity and one Allis-Chalmers compressor of 2,600 cubic feet capacity, giving a combined air capacity of 17,300 cubic feet per minute. This is distributed to the ways through a 16-inch high pressure air main and by means of smaller mains throughout the yard to the various shops, the outfitting wharf and

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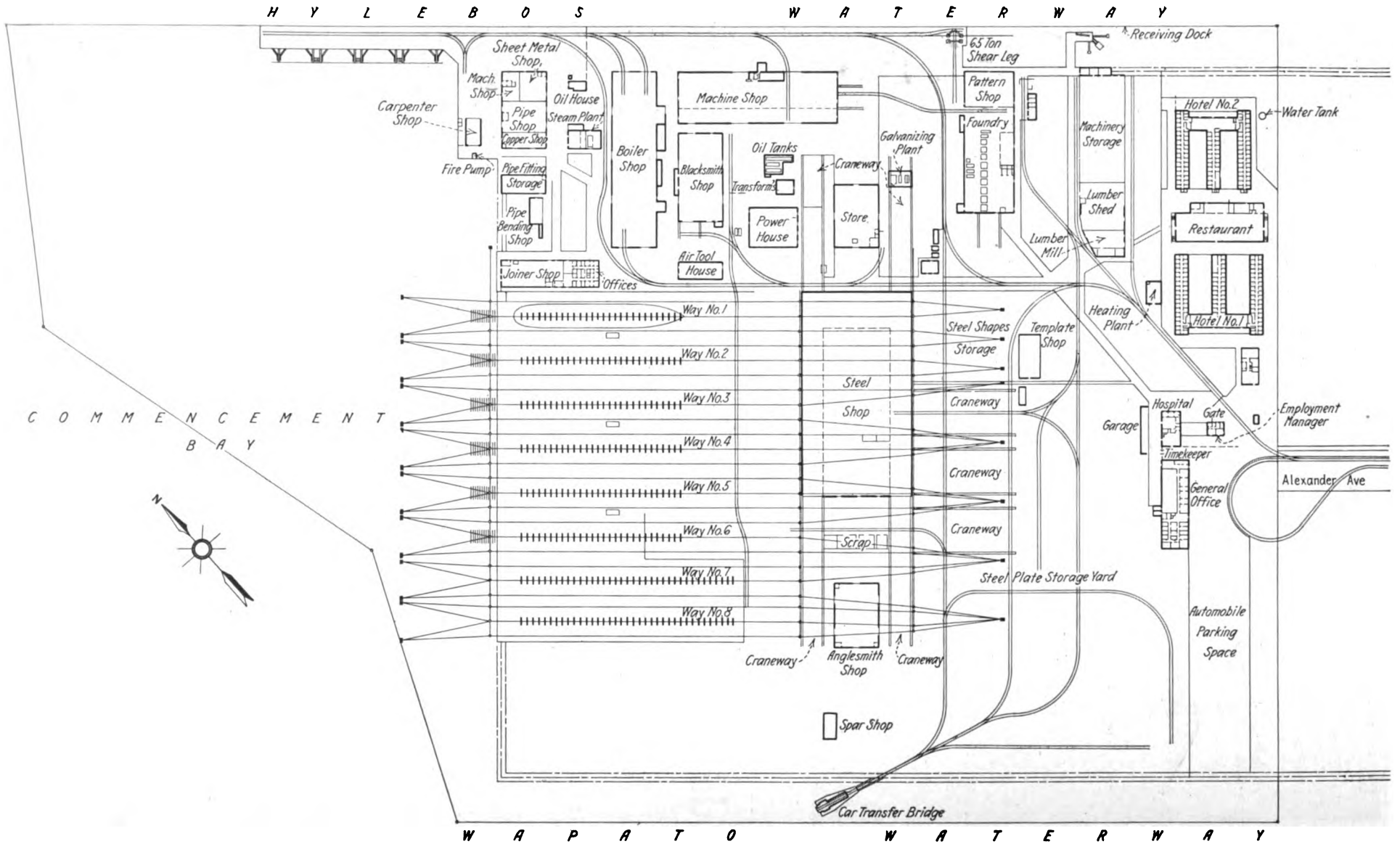

Plan of Todd Model Shipyard at Tacoma, Wash.

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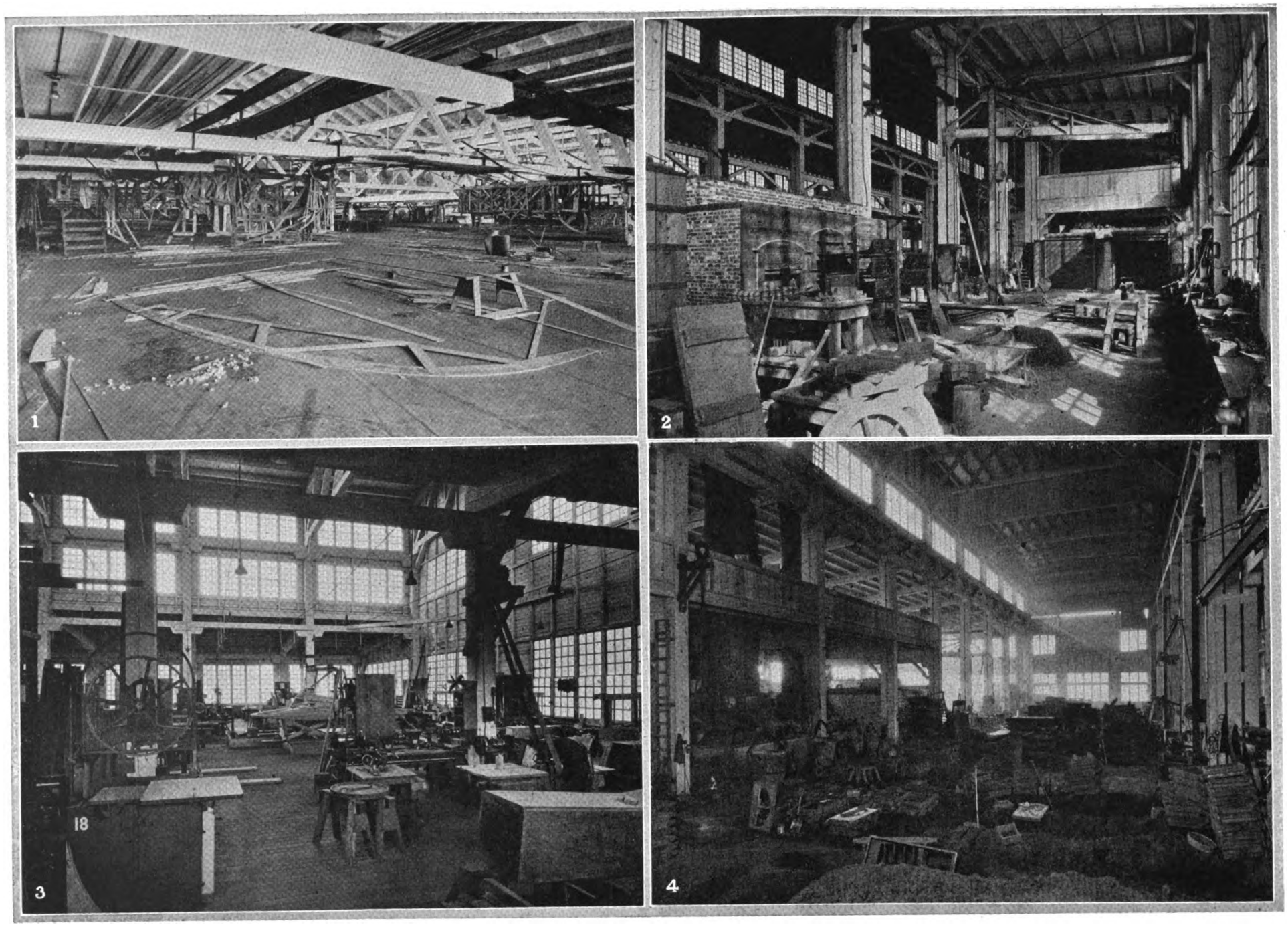

Interior Views in Shops at Todd Tacoma Plant: (1) Mold Loft, (2) Coremakers' Side of Foundry, Showing Core Ovens, (3) Section of Pattern Shop, (4) Foundry

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the assembling yard, making a total of over 2 miles of air mains of all sizes.

Fabricating Shop and Mold Loft

The fabricating shop is located at the head of the ways and is 380 feet long by 150 feet wide. The laying off and finishing bay are served by means of 5-ton electric cranes and the transportation of material across the shop for its various operations is cared for by means of lighter electric cranes operated from the shop floor. The second floor of the fabricating shop is utilized as a mold loft and the extensive floor space gives ample room for this purpose. A separate shop is provided for anglesmith work, situated adjacent to the fabricating shop.

Foundry and Pattern Shops

The foundry and pattern shops are located in a building 111 feet by 320 feet in plan; an 80-foot two-story portion of which is utilized for a pattern shop on the second floor and pattern storage on the first floor. The balance of the shop, 240 feet in length, comprises the foundry and contains all modern machinery and equipment for the economical making of gray iron and brass castings. Concrete beds are provided for heavy castings such as cylinders, bedplates, engine columns, etc., and heavy electric cranes provide adequate means for handling material within the shop.

Machine Shop

Direct rail connection from the foundry to the machine shop provides for efficient handling of castings for finishing. This shop is of the type with a bay down the center extending to the roof and two side bays two stories high. The central bay is served by two 50-ton cranes and in this portion is located the heavy lathes, presses and mills and the platen for engine erection purposes. The side bays are equipped with the various tools and equipment for lighter work thus fitting this shop for the complete handling of all classes of work a machine shop may be called upon to do.

The tools in the machine shop are so arranged with reference to the class of work they perform that all material progresses steadily towards the center of the shop and the erection platen from which point it goes directly to the outfitting wharf as completed material ready for installation.

Blacksmith and Boiler Shops

The blacksmith and boiler shops are fully equipped along modern lines for handling any work in this direction that may arise. The feature of the blacksmith shop is the steam hammer equipment which ranges in size from 200 to 6,000 pounds' capacity sufficient for the economical handling of all classes of work.

The boiler shop is divided into two bays and served by 50-ton electric cranes. In both these shops the same idea of efficient material handling has been carried out so that the work progresses through the various operations from one end of the shop to the other and thence out via railroad transportation to the outfitting wharf.

Other buildings include a lumber mill, paint and joiner shops, a two-story storehouse, machinery storage building and a two-story building containing a pipe shop, copper shop and sheet metal shop on the first floor and a rigging loft and electrical shop on the second floor.

The Tacoma plant of the Todd Corporation is located on Puget Sound on a site that three years ago lay under 18 feet of water. Since that time it has established a fine record having launched twenty-six 7,500-ton steel hulls, a 6,500-ton motorship and three scout cruisers for the United States Navy.

(Photograph by Kadel & Herbert News Service, N. Y.)

Some of the Battleships the United States Would Scrap in Accordance with Disarmament Plans: (1) U. S. S. Georgia, (2) U. S. S. Missouri, (3) U. S. S. Connecticut, (4) U. S. S. Washington (Latest Type, Electrically Driven), (5) U. S. S. Vermont

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Electric Propulsion of Ships*

By W. E. Thau†

This paper deals primarily with the electric propulsion of ships, except wherein a comparison of some particular feature or characteristic warrants a reference to some other type of drive. In dealing with electric propulsion, it is necessary to consider all classes of ships, and this leads to two broad, general classifications, such as merchant ships and war vessels, which are taken up in the order named in the paper.

THE ultimate purpose of a merchant ship is to earn money. From this standpoint, the factors of reliability, economy, weight, space, cost, operation and maintenance are involved in the propulsive equipment. Therefore the type of drive most suitable is that which excels in all or the most important of these factors. The relative importance of these items varies with different ships, depending upon the trade route, cargo, etc., with the result that there is a definite and logical field for each of the principal types of drives, such as reciprocating engine, geared turbine, turbine-electric, Diesel and Diesel-electric. Since many general comparisons of the principal types of drives in regard to these factors have been given in recent articles in the technical press it is not the intent of the present paper to take up this phase of the subject, but rather to analyze the principal types of electric propulsive equipments and to show in general how they fulfill these requirements.

Reliability

The universal use of, and the indisputable success of electrical apparatus on land is sufficient testimony in behalf of its reliability. The absence of reciprocating parts makes electrical apparatus with its simple rotation as reliable as can be desired. It can almost be said that there are no mechanical troubles with electrical machinery. Broadly speaking, there are no new principles involved in the application of electrical apparatus to ship propulsion. It is true that ship conditions differ from land conditions in certain respects, but there is no phase of the application which presents any really serious difficulty. The most important adverse condition is the deleterious effect of salt and moisture, which is easily surmounted by proper insulation of the windings and circuits, as is obvious from the several years of successful operation of present electric propulsion equipments. There can, therefore, be no question as to the reliability of electrical propulsive equipment.

Economy

Economy is an important factor, and must be given due consideration. To properly analyze this item, it is necessary to consider all equipment involved in the propulsion, with respect to fuel, water, lubricants and supplies. The relative proportions of these items vary considerably in the different types of propulsive equipments. The turbine-electric and the geared turbine compare very closely in economy when all items are considered. The losses in the reversing elements of geared turbines, the losses in the gears and the power required to circulate the additional lubricating oil, detract appreciably from the gain which the geared turbine would otherwise have over the turbine-electric because of the inherent electrical losses in the latter. Generally speaking, the net economy of a properly designed and constructed geared turbine drive should be better than a turbine-electric drive, even though full advantage is taken of every practical source of gain in the latter. The difference, however, is perhaps hardly of sufficient magnitude to be the dominating factor in arriving at a final selection. The economy of a reciprocating engine drive is obviously poorer than that of a properly designed turbine drive of either type for the reason that the reciprocating engine cannot utilize the same expansion of the steam.

It has been advanced that the turbine for the turbine-electric system, being a one-direction rotation machine, can utilize higher superheat than the geared turbine, because of the reversing element of the latter, thus resulting in better overall economy. With the present installations, this condition is true to some extent. However, with proper attention given to this factor, geared turbines can be designed to operate without detriment with steam superheated 150 to 200 degrees F., which is fairly close to the practical limit of superheat on board ship, as there are other items aside from the turbines which are affected by high superheats to the extent of fixing limitations.

Obviously from a fuel consumption standpoint, the direct Diesel and Diesel-electric propulsive equipments offer by far the best economy. Of these two types, it would appear, offhand, that the direct Diesel drive is decidedly superior to the Diesel-electric; however, it will be shown later that there are certain limitations in the direct Diesel drive which offset its advantage in fuel per brake horse-power-hour over the Diesel-electric. Here again, it is obvious that all items related to the propulsive equipment must be taken into consideration to obtain the ultimate answer.

Weight

The item of weight would probably show more variance than other items owing to differences of arrangement, design, foundations, etc., in the practice of the several shipbuilders. The importance of weight depends upon the type of ship, cargo, and trade route. Usually, however, weight is an important item as it has a direct effect upon the total fuel consumption and the amount of cargo that can be carried with a given displacement. Here again, it is necessary to consider all items related to the propulsive equipment. A correct comparison of weight necessitates that the equipments under consideration be on the same basis relative to overload, factor of safety and arrangement. This is particularly important in comparisons between electric drive equipments. Where one equipment affords an advantage in flexibility of reserve, however, it is usually at some sacrifice in weight, and an allowance must be made.

Space

Space is important in that it has a direct bearing upon the bulk of cargo that can be carried. Its relative importance depends somewhat upon the location of the machinery, *i. e.*, whether the machinery is located amidship or aft, or both. Space is affected by the distribution of machinery and the relative saving depends somewhat upon the practice of the various shipbuilders in that respect. General analysis of the space factors which have been made thus far gives the advantage to the direct connected Diesel and Diesel-electric types of propulsive equipment, the saving being effected by

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the elimination of the boilers and reduction of fuel and water tanks. Of the turbine-electric and geared turbine types, the space factor is in favor of the geared turbine, except in special cases. The general arrangement of the engine room, number of propellers and the beam of the ship have a direct effect upon the space occupied as a result of machinery distribution. By locating the condensers underneath the turbines in electric drives, the total floor space can be greatly reduced.

COST

A definite comparison of costs is still a difficult task owing to the continued unsettled conditions. On the basis of equal performance in regard to propeller torque and speed, the cost including all items related to the propulsive equipment should run in the order of direct-Diesel, turbine-electric, geared turbine, and Diesel-electric, the latter being the

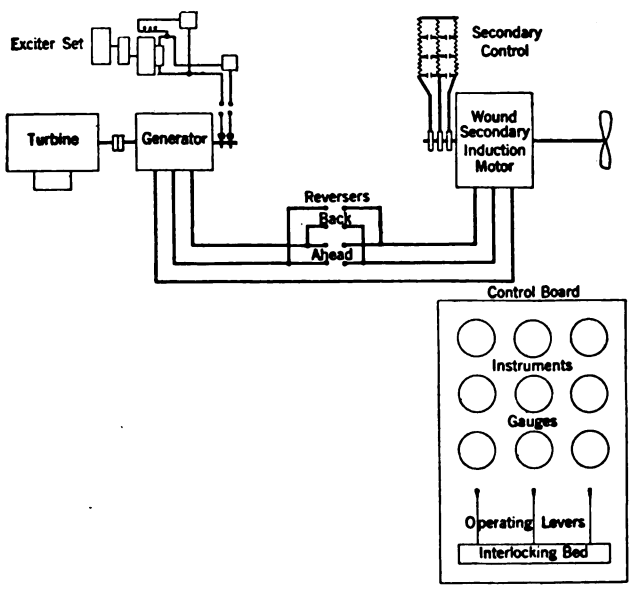

Fig. 1.—Diagrammatic Scheme of Connections for Wound-Secondary Induction-Motor Drive

cheapest. The paradox in the relative cost of direct-Diesel and Diesel-electric is explained by the condition that small Diesel engines and generators for Diesel-electric drives can be manufactured ultimately on a large production basis and stocked, whereas the engines for direct-Diesel drive, and to a large extent, the two types of turbine drive, because of their large size and weight, must almost of necessity be a building proposition. On the basis of standardized drives, there should not be a great deal in favor of the geared turbine as compared with the turbine-electric drive. This comparison will vary somewhat with the different manufacturers.

The initial cost of the propulsive equipment has a direct effect upon the net earning power of the ship, because of interest, depreciation and insurance charges, and therefore, cost is an important item.

OPERATION

In regard to operation, it is realized that the present operators are largely men who are more familiar with reciprocating engines than with other types of machinery, and that for this reason, certain difficulties are likely to be encountered in placing electrical equipments in their hands. The author believes that this thought should not be a consideration, as it is a temporary condition only. Successful operators of electrical machinery need not have sufficient knowledge of it to understand the details of its design. This is not the case on land and there is no greater reason for it on the sea. The operator should, however, know the operating characteristics of electrical apparatus and how to take care of it.

The same question was raised in the case of geared turbines only a few years ago, yet today there is nearly a sufficient number of competent geared turbine operators to take care of all the geared turbine ships. The same will be the case with operators for electric ships. It is merely a matter of training and education and it is certainly a reflection upon the intelligence of the age to classify the present limited knowledge as an obstacle for consideration.

The following is a probable list of the operating personnel for the principal types of drives. The cost of operating personnel as based upon this list would, therefore, be in the order of,—direct-connected Diesel, turbine-electric, geared turbine, reciprocating engine, and Diesel-electric:

TABLE OF PROBABLE OPERATING PERSONNEL

		Reciprocating engine *	Geared turbine *	Turbine electric *	Direct connected Diesel	Diesel electric
Total Crew	Chief	1	1	1	1	1
	1st Asst.	1	1	1	1	0
	2nd Asst.	1	1	1	1	1
	3rd Asst.	1	1	1	1	1
	Jr. Engrs.	0	0	0	3	0
	Electricians	0	0	1	1	1
	Oilers	3	3	3	6	6
	Firemen	6	6	6	0	0
	Total	13	13	14	14	10
On each watch	1st, 2d or 3d	1	1	1	1	1
	Junior Engrs.	0	0	0	1	0
	Electricians	0	0	0	0	0
	Oilers	1	1	1	2	2
	Firemen	2	2	2	0	0
	Total	4	4	4	4	3

*Based on oil burning ships. For coal ships, the operating personnel would be augmented by three coal passers.

MAINTENANCE

Although there are practically no data available on the maintenance of electrical propulsive equipments (except battleships), there is no reason to anticipate any great difference between sea and land practice. As a matter of fact, there is reason to anticipate less maintenance for the reason that the load conditions and control operations are less severe than is the case with most land installations involving large machinery. If the equipment is given proper care and inspection, the maintenance item will be low, as the absence of rubbing parts (except for the bearings), leaves little to get out of order. Electrical machinery does not wear as is the case with other machinery. Furthermore, all probable repairs are such as can be made aboard the ship without the use of an elaborate machine shop.

PERFORMANCE CHARACTERISTICS

The inherent performance characteristics of electrical machines are particularly well suited to ship propulsion. Having identical operating characteristics in either direction of rotation, all types of electric drive inherently afford, or can be made to afford, full torque and power for reversal. For reasons of economy, space and cost, the reversing element of a geared turbine is designed to give only 40 percent to 60 percent power in the reverse direction. It has been claimed that full reverse power is not essential to a merchant ship, and this is true under ordinary conditions. In emergency, however, it is desirable to stop the ship very quickly, and in this connection it might be pointed out that the electric ship can be stopped in considerably less time than a geared turbine ship. This is not altogether the result of less backing power, but is due to a great extent to the inefficiency of the reversing element of the geared turbine causing an enormous draft on the boilers which greatly reduces the steam pressure.

In reversing, the energy put into the screws by the action

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of the water and the stored energy in the rotating parts attached to the propeller shaft, must be dissipated in some manner. In the case of the geared turbine, this energy is consumed in doing work on the steam. In the case of alternating current electric drives, the energy of reversal is dissipated in the motor and generator windings, the rotors of the motors, or in external resistors connected to the rotor circuits, depending upon the type of motor used. In direct current electric drives, the reversal energy must be absorbed elsewhere in the system. The amount of energy to be dissipated or absorbed in the case of a given ship depends entirely upon the time taken to stop the screws. The instant the screws commence to turn over in the reverse direction, the system must supply the energy and all further stopping energy is dissipated at the propellers. There are two factors to be considered in stopping, namely, the energy returned through the propellers, and the stored energy in the propellers and the motor armatures. Analysis shows that reversing even at full speed is not a serious problem, and that it does not place as severe requirements upon the electrical machinery as does turning with hard-over rudder. The details of the distribution and absorption of the energy of reversal would occupy too much space to be discussed at this time. Suffice it for the present to say that the inherent facilities afforded by electrical systems for dissipating energy and for giving full power in either direction are what make the electric drives ideally suited for stopping. The time required to stop an electric ship is the same as, or less than, that of other drives.

Description of Electrical Propulsive Equipments

General Classification.—Electrical systems for ship propulsion may be classified into two general types from the standpoint of the prime movers, namely, turbine-electric and Diesel-electric. Due to the inherent performance of these two types of prime movers, both kinds of electric machinery are used; alternating current machinery with turbine-electric because the alternating current generator is inherently suitable for direct connection to the economical high-speed turbine; and direct current machinery with Diesel-electric drive because the inherent characteristics of the direct current generator are ideally suited to Diesel engine performance.

The electrical equipment for turbine-electric drive may be further subdivided as follows, in regard to the type of motor:

1 Induction
- Wound secondary
  - Ordinary, and with
  - power factor correction
- Squirrel cage
- Combined squirrel cage and wound secondary

2 Synchronous

In the case of the Diesel-electric drive, there is no broad subdivision. As a minor classification, this type of drive might be subdivided with respect to the method of generator operation, *i. e.*, series and parallel. However, series operation is so vastly superior that parallel operation can be disregarded except for the purpose of comparison.

Units Involved

A complete turbine-electric drive involves the following apparatus:

Boiler plant
Evaporation plant
Condenser plant
Turbine
Generator
Motor
Oiling system
Exciter set
Control

A complete Diesel-electric drive involves the following apparatus:

Diesel engines
Generators
Motors
Small auxiliary air compressors
Air bottles
Exciters
Fuel pumps, (if not attached to engine)
Lubricating pumps, (if not attached to engine)
Control

Turbine-Electric

With turbine-electric drive, the electrical equipment is of the alternating current type, principally for the reason that alternating current turbo generators are inherently better suited for the high economical speeds of turbines. The speed at which the turbine operates is influenced by the propeller speed because of the limitation in the number of poles of the motor. Theoretically, an alternating current motor can be built for any even number of poles, but in practice such factors as power factor (induction motor), diameter and assembly, fix the limit in the neighborhood of 60 to 72 poles. As the motor speed and number of poles fix the generator and turbine speed, there is consequently an approximately fixed limit to turbine speeds. Incidentally, in the case of practically all merchant ships, this speed is lower than the most economical speed of the turbine. As the propeller is most efficient when designed and operated at low speeds, it is advisable not to exceed 90 to 100 revolutions per minute for the ordinary merchant ship.

Assuming a propeller speed of 100 revolutions per minute, a 60-pole motor and a two-pole generator, the generator and consequently the turbine would operate at 3,000 revolutions per minute (neglecting the slip in case of the induction motor). This gives a reduction from the turbine to the propeller of 30:1, which is approximately the same irrespective of the type of motor used.

Fig. 1 shows a diagrammatic scheme of connections for an induction motor drive of the wound secondary type. Power is supplied from the turbine-driven generator to the induction motor through one of the reversers. The generator is excited from one of the auxiliary geared turbine direct current sets. Whether the auxiliary set would supply generator excitation only, or simultaneously furnish ship's auxiliary power, depends principally upon the electrification of engine room auxiliaries, winches, etc.

The turbine is under the control of a governor capable of maintaining constant speed over about 75 percent of the entire speed range. The governor speed control valve is regulated from the control stand by an oil relay valve or system of rods and levers, depending upon the type of governor used. The propeller speed is adjusted by throttling the turbine as in the case of a geared turbine drive. The turbine is started and brought up to its "idling speed" by the throttle valve at the turbine.

Similarly, the generator field switch and rheostat, and the ahead and back switches are controlled from the control stand by means of levers. These levers are mechanically interlocked so that it is necessary to follow the proper sequence of operations in starting, stopping and maneuvering.

Usually, the reverses are interlocked with the field lever so that the field lever must be in the "off" position before the reversers can be opened or closed. Similarly the field is interlocked with the turbine speed control lever so that the control valve must be set for low speed before the field can be opened or closed.

The secondary control is automatic, being either of the solenoid contactor or motor-operated contactor type. The actuating means is energized through contacts on the field lever near the end of its stroke. This arrangement insures the establishment of voltage at the motor before closing the secondary accelerating switches. Similarly, moving the field lever to the "off" position, opens the secondary switches.

The operating levers and a complete complement of electrical instruments and steam gages are arranged convenient to the operator, the instruments and gages being mounted on a panel directly above or in front of the levers. By observing the instruments, the operator will be kept informed at all times of the performance of all machines, even though

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the machines be obscured from his view when he is on watch.

By a suitable arrangement of the switches and control levers, the entire maneuvering of a ship of any size and any number of screws, can be under the complete control of one operator.

The interlocking system necessitates the following sequence of operation:

A—Starting Ahead (Turbine Idling):

1. Close REVERSER in "Ahead" position,
2. Close FIELD and establish excitation,
3. Adjust TURBINE SPEED to desired value after secondary is completely short-circuited. (Indicated by pilot light)

B—Stopping:

1. Move TURBINE SPEED control lever to idling position,
2. Move FIELD lever to "off" position,
3. Move REVERSER to "off" position.

C—Starting Back:

1. Close REVERSER in "Back" position,
2. Close FIELD and establish excitation,
3. Adjust TURBINE SPEED to desired value after secondary is completely short-circuited.

D—Reversing (From Ahead Operation):

1. Move TURBINE SPEED control lever to idling position,
2. Move FIELD lever to "off" position,
3. Move REVERSER from "Ahead" to "Back" position,
4. Move FIELD lever to full excitation,
5. Bring up TURBINE SPEED after motor has pulled into step.

The above description applies to a single screw drive having but one turbine set. For a multiple screw ship having

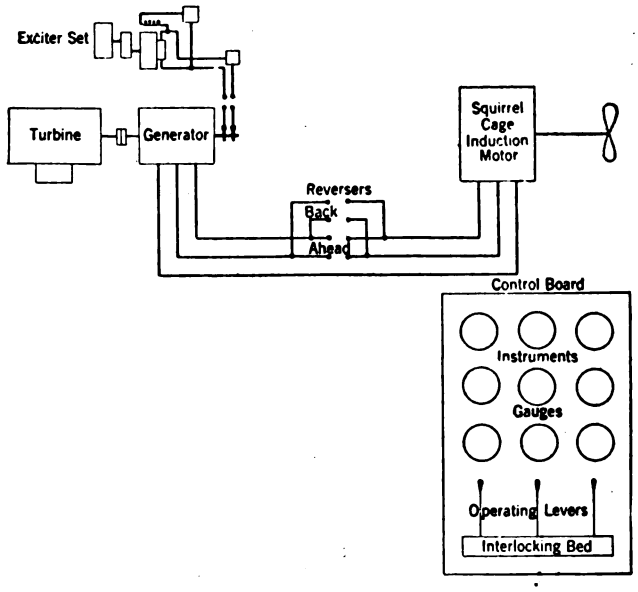

Fig. 2.—Diagrammatic Scheme of Connections for Squirrel-Cage Induction-Motor Drive

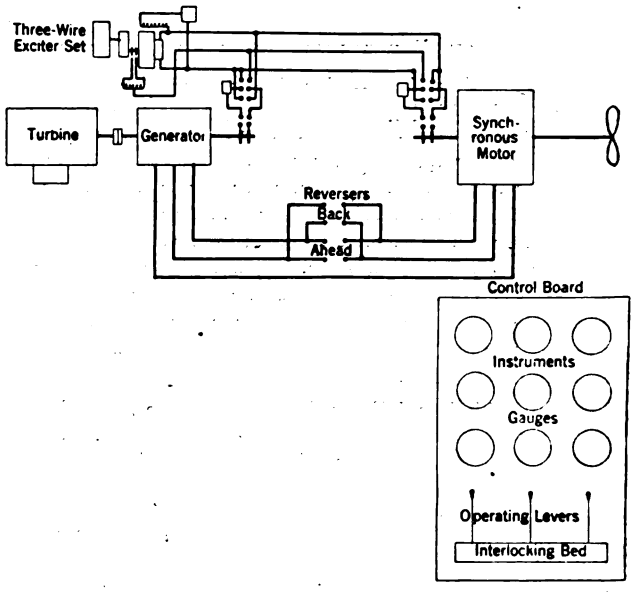

Fig. 3.—Diagrammatic Scheme of Connections for Synchronous Motor Drive

generating sets for port and starboard sides, the operation would be the same for each side of the ship, as just described.

The above operations are based upon switching when the current in the circuits has been reduced to very low values, or nearly dead circuit conditions. This arrangement is not really necessary, as, with small powers, it is not essential to open the generator field; however, it may be justified in the light of conservatism. In any event, the reversers are so designed that they are entirely capable of opening full power.

The salient features of the wound-secondary-induction-motor drive are its inherent torque characteristics and the ease of handling. While the secondary control necessitates a few additional switches, this is fully compensated for by the fact that the propeller energy of reversal, and the slip energy of reversal and starting is dissipated in resistors external to the motor. The importance of this is dependent upon the amount of reversing that is done, particularly from full speed. This system, therefore, represents the most conservative arrangement of turbine electric drive.

The squirrel-cage motor system is shown in Fig. 2, and it will be noted that the electrical connections are the same as for the wound-secondary motor system, except that there is no secondary control. This system is, therefore, somewhat simpler than the wound-secondary motor system from an electrical connection standpoint, both inside and outside the motor. It also has a slight advantage in cost in that the motor is less expensive to build. The sqirrel-cage motor is shorter because of the absence of collector rings. It has a disadvantage in conservatism and torque characteristics.

The power factor of either of the induction motor systems is less than unity, the exact value depending upon the number of poles and certain design features. For the ordinary merchant ship requirements, these motors would have power factors of approximately 70 percent, the wound-secondary motor having the higher power factor of the two, by a small amount. The induction motor drive, therefore, requires a generator with kv-a. capacity in excess of its kilowatt capacity, which adds somewhat to its weight and size, and which detracts a very small amount from its efficiency.

The efficiency of the squirrel-cage induction motor of ordinary design is slightly less than that of the wound-secondary motor, for the reason that sufficient permanent resistance must be incorporated in the rotor windings to obtain the required torque for reversal without excessive current. In large motors with special double secondary windings, the required torque can be obtained without excessive current and the running efficiency can be improved somewhat. Such motors are in use on propeller drives at the present day.

TURBINE ELECTRIC
(Synchronous)

Fig. 3 shows a diagrammatic scheme of connections for a synchronous motor drive. Power is supplied from the turbine driven generator to the synchronous motor through one of the reversers. The generator and motor fields are excited from a three wire, direct current exciter set. The synchronous motor system differs from the induction motor system only insofar as the synchronous motor itself affects the details of control and generator capacity, the main features of turbine-electric drive being otherwise the same.

Although the characteristics of the ordinary synchronous motors are not suitable for ship propulsion, the synchronous

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motor can be modified to give characteristics which meet the requirements. The modification consists in providing the rotor with a substantial induction winding of such design and arrangement as will not seriously detract from certain purely synchronous motor characteristics which are desirable.

The maneuvering operations can be accomplished in more than one way. If appreciable torque is required to reverse, the method which appears to be most favorable is to utilize the synchronous characteristics and the induction characteristics at different stages of the reversing cycle. The motor is stopped as a synchronous generator loading into the generator windings which form a dead load (generator field not being excited), then is brought up to nearly synchronous speed in the reverse direction as an induction motor, and finally is pulled into step with the generator as a synchronous motor. With this method, the sequence of operation for reversing would be approximately as follows:

1. Reduce turbine to idling speed (25 percent),
2. Open generator and motor fields,
3. Reverse motor connections,
4. Apply motor field excitation bringing motor to rest,
5. De-energize motor field,
6. Energize generator field to double value, bringing motor to nearly synchronous speed as induction motor,
7. Apply normal excitation to motor field, pulling motor into synchronism with generator,
8. Adjust speed to desired value.

The method described above is preferable where appreciable torque is required during reversing. Usually, however, sufficient torque will be developed by the simpler method of reversing as an induction motor, in which case the cycle of operation will be as follows:

1. Reduce turbine to idling speed (25 percent),
2. Open generator and motor fields,
3. Reverse motor connections,
4. Energize generator field to double value, bringing motor to rest and reversing it to nearly synchronous speed, as an induction motor,
5. Apply normal excitation to motor field, pulling motor into synchronism with generator.
6. Reduce generator field to normal,
7. Adjust speed to desired value.

This method, therefore, simplifies the sequence to the extent of omitting one step and eliminating the generator action of the synchronous motor.

Although eight and seven steps respectively have been indicated in the sequence, some of the steps can be combined so as to reduce the actual number of lever operations to a reasonable amount.

Although the synchronous motor requires special design and introduces additional complications in the control, it has the important inherent characteristic of unity power factor. The unity power factor results in slightly decreased weight and size, and consequently less cost of the motor and generator. Taking the drive as a whole, and considering that both motor and generator must be excited from a separate source at a cost of at least twice the steam per kilowatt-hour as the main turbine, the efficiency improvement over the induction motor drive is more apparent than real. Therefore, the principal advantages of the synchronous motor drive as compared with the ordinary induction motor drive are a slight saving in cost, weight and space, with a possible inappreciable margin of efficiency.

TURBINE ELECTRIC

(Induction with Power Factor Correction)

The unity power factor advantage of the synchronous motor system is also available with a wound-secondary induction motor system in which the low lagging power factor is corrected to unity. This arrangement not only provides a system of the same weight, space and cost of the synchronous system, but in addition possesses the superior torque characteristics and simplicity of control of the wound-secondary induction system.

The diagrammatic scheme of connections is shown in Fig. 4. It will be noted that this is the same as the wound-secondary induction motor system shown in Fig. 1, except that power factor corrective apparatus has been added. The scheme functions in the same manner and sequence as that shown in Fig. 1 until the motor is in step with the generator, and at this point the power factor corrective apparatus is caused to function. The corrective apparatus consists of a Le Blanc phase advancer driven by a small direct current motor, the speed of which may be varied to suit the power factor correction desired. The function of the phase advancer is somewhat similar to that of the direct current exciter in the case of the synchronous motor in that it supplies excitation to the induction motor. The connection is made to the secondary or rotor winding and thus excitation is supplied through the secondary instead of through the primary, with the result that the primary current is all "power" current, which means "unity" power factor.

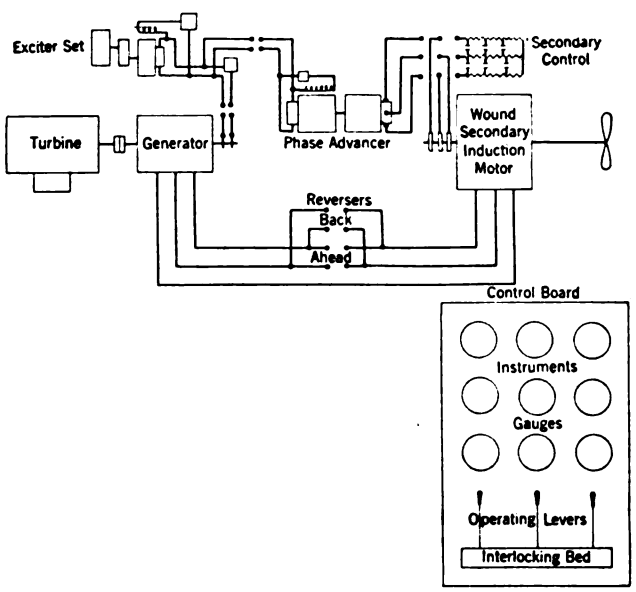

Fig. 4.—Diagrammatic Scheme of Connections for Wound-Secondary Induction-Motor Drive with Phase Advancer for Power Factor Correction

The phase advancer is a small commutating machine of very simple construction. The losses in the phase advancer consist of the internal copper loss due to the secondary current, almost negligible iron losses, friction, windage and brush drop. The total of these losses is very little and compares very favorably with the excitation power of the synchronous motor.

The induction motor used with this system is simple in construction, smaller, lighter and consequently less expensive than the motor used with the ordinary wound-secondary induction motor system. The generator is the same as that for the synchronous motor drive. Thus, the induction motor drive with the phase advancer not only provides the advantages resulting from unity power factor, but in addition provides the superior torque characteristics of the wound-secondary induction motor for maneuvering, and also obviates the necessity for synchronous operation with the generator. In fact, it combines all the desirable features and characteristics of both systems, without complications.

(To be concluded)

Ash Ejector Operates Without a Pump

AN ash ejector operated by specially designed steam nozzles was demonstrated at the Marine Exposition by the Victor Engineering Company, Philadelphia, Pa. The use of these nozzles makes pumps unnecessary for

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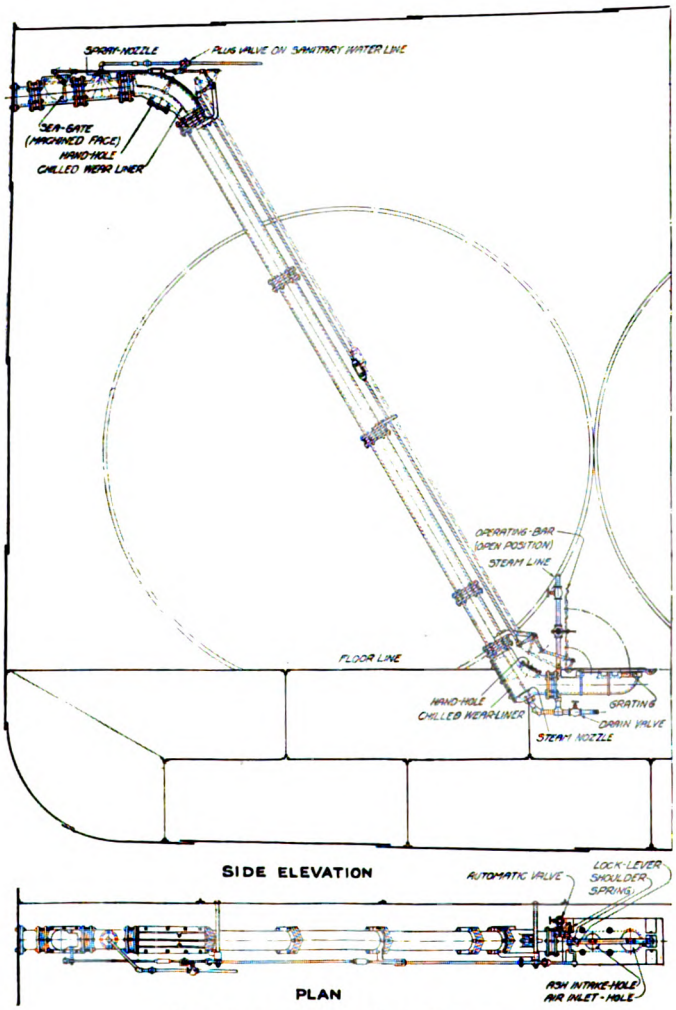
ejecting ashes. The possibility of flooding the boiler room is eliminated and it is claimed that the loss of steam by the use of the system is reduced to a minimum.

The steam nozzle used is located in the lower elbow of the apparatus as indicated in the accompanying illustration. This nozzle directs a jet of steam through an inclined pipe,



Details of Victor Ash Ejector

thereby creating a suction in the horizontal part of the ejector located under the floor of the boiler room and a pressure as far up as the discharge end, which is located above the water-line. An automatic arrangement is provided for opening and shutting off the steam line so that the smallest possible steam jet will be required to create suction and pressure enough to allow the device to function properly. The nozzle itself is specially designed to give the maximum effect with a low steam consumption.

The different operations of turning on the steam, eliminating the dust, opening the sea gate and uncovering the ash intake—located flush with the floor—are combined in a single stroke of the operating bar. To reverse these operations it is only necessary to bring the bar back to a closed position.

Because of the fact that the size of the ash hopper has been reduced, it has been possible to keep it level with the floor so that ashes may be shoved directly into the hopper.

Air Compressors for Motorships

BULLETINS were distributed at the Marine Exposition by Albert Otto & Son, Inc., New York, describing Krupp single cylinder and double cylinder 3-stage high pressure air compressors which are now on the market in this country.

The single cylinder type K-C having a capacity of 230 cubic feet of free air per minute has a delivery pressure of 1,000 pounds per square inch when driven at 275 revolutions per minute. At this pressure 105 horsepower is required to drive the machine. The compressor is of the vertical enclosed box frame type having large bearing surfaces and a forced lubrication oiling system. The air is cooled at the various stages.

The type K-D two-cylinder machine has a normal capacity of 350 cubic feet of free air per minute delivering a pressure of 1,000 pounds per square inch when operating at 350 revolutions per minute. In this case 160 horsepower is required. In general the machine is similar to the type K-C.

Detecting Salt in Boiler Feed Water

TO overcome the reduction in steam power caused by the presence of salt in the boiler the McNab Company, Bridgeport, Conn., has developed a salt detector which will indicate the amount of salt entering the boiler through the feed line. When any sign of salinity is thus shown the engineer in charge is able to take precautionary measures against its entrance into the boilers.

Simplex Salt Detector

The McNab simplex salt detector is usually located in a convenient position in the engine room and connected by small copper tubing to the main feed line. Its operation is based upon the principle of the high electrical resistance of fresh water which is rapidly reduced when foreign compounds enter it. A meter is arranged within the salt detector which indicates the quantity of salt in grains per gallon that may pass through the feed line. In addition an incandescent lamp is arranged which will glow when as little as two grains of salt per gallon is present, the glow increasing to a bright light as the density of the solution increases. As a further warning an audible alarm is arranged within the detector which can be set to sound at any fixed percentage of salt density.

Insulation for Superheated Steam

IN order to secure the greatest benefit from the use of superheated steam, investigation of the subject indicates that increased care must be taken in providing proper insulation.

Bulletins distributed by the Magnesia Association of America at the Exposition outline the work of the research fellowship at the Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa., which has been carried on with the idea of making 85 percent magnesia pipe and boiler covering more efficient. As a result of this work, the association is insisting on thicker covering of superheated steam pipes, the latest specifications recommending double standard thickness 85 percent magnesia.

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Substitutes for Natural Wood for Shipbuilding Purposes

By Horace Holden Thayer*

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

SUBSTITUTES for natural woods in shipbuilding are mainly of interest in connection with the joinerwork and may be divided into three general classes as follows:

(a) Composition Boards—composed of paper stock of various kinds, or similar materials, made up into sheets of the desired thickness.

(b) Plywood—composed of layers of thin wood or veneer glued together.

(c) A combination of wood and metal which we may call Flymetal—having a core or center layer of wood with thin metal surfaces cemented to it.

Steel partitions are used in place of wood joinerwork for boundary and division bulkheads of toilet and wash rooms and similar service where wood proves short lived or unsanitary; and also for galley bulkheads and other locations where a fireproof material is required; but they do not call for special consideration here.

The principal characteristics and uses of the three classes of materials above listed are:

Class (a) Composition Boards

Material of this class is of value on shipboard for panels that are to be painted. It cannot support loads and when in flat sheets has slight resistance to deformation. Some makes can be molded to curvature at the shipyard for ornamental arches between beams and similar service, while others can only be successfully thus handled at the point of manufacture. Some makes are built up on a cylinder, each revolution of which adds a layer of thickness, and thus they have a laminated structure like cardboard; while others are made of the desired thickness without this building up in layers. Some makes are given a special treatment to render the material sufficiently waterproof and some can be supplied either with or without special fire resisting properties, introduced by an impregnation treatment. Boards ¾ inch thick are built up by at least one of the manufacturers with a view toward their use as entire bulkheads but the writer does not consider this a field for products of this nature on shipboard that is likely to be successful. Full particulars regarding the particular nature and properties of any make can be obtained from the manufacturer.

For success with this material it is essential that it satisfy the following requirements:

To wear well.
To be reasonably waterproof.
To have freedom from bulging and not too great a tendency to warp.
To have slight expansion and contraction with changes of atmospheric conditions.
To be stiff enough to retain its shape whether flat or formed to a curve.
To have a smooth surface.
To take paint well.

A number of products of this nature have been placed upon the market from time to time and have failed to make good. Results of actual service on shipboard are the only safe guide to the selection of such material. The greater the experience of the manufacturer, the more uniform will be the product.

Having selected the material, great care is necessary in its installation. With the best products of this kind of which the writer is cognizant the following rules should be observed:

In order not to show crowning, panels should be at least ¼ inch thick, 5/16 inch is preferable and ⅜ inch is better still.

A solid T & G bulkhead backing is necessary for vertical panels ¼ inch or 5/16 inch thick and recommended for the ⅜ inch. The building of a complete bulkhead takes the place of the skeleton framework that would otherwise be required and also of the wood backing that is needed wherever furniture, fixtures, etc. are to be fastened to the panels. It also guards against injury to the panels from blows which would otherwise badly deface them.

The panels should be held in place in such manner that they will be free to expand and contract. In many cases the moldings around the edges will suffice, although a few finishing nails near the center are of advantage on large wall panels and should be used to support the weight of large overhead panels.

To prevent the possible buckling of the panels due to expansion about ⅜ inch should be allowed all around between the edge of the panel and the part of the molding against which it could seat itself. An attempt to butt panels edge to edge in order to produce the effect of a large flat surface will result disastrously unless carried out with great care and with ample provision against movement from expansion at the joint and ample provision for such movement elsewhere.

All wood backings and the inner surfaces of the panels should be painted.

Class (b)—Plywood

Material of this class is of value on shipboard for both painted and natural finish panels and also for entire bulkheads. This material when properly made is stronger and has greater resistance to deflection than a corresponding thickness of wood. It therefore does not require backing and, if desired, both sides of the panel can be exposed. For a painted surface the outside plies may be of any wood of suitable properties which will take paint well, such as gum, birch or poplar. For natural finish or so-called "bright work" the desired hardwood veneer is used and selected for color and beauty of grain.

Plywood can be readily molded to such curvature as before referred to and even to some extent to double curvature. Canoes have been molded out of a single sheet of it, the sides being fastened together at the bow and stern after molding.

For success with this material it is essential that it satisfy the following requirements:

The face veneers should be of high grade manufacture.
It should have an odd number of plies, or layers, of wood.
The center ply to be preferably of such material and thickness as to compensate for the strength in both directions of the layers adjacent to it and prevent distortion with changes in atmospheric conditions.
The side plies to be in pairs which exactly correspond as to properties of wood, thickness and direction of grain.
The grain of one ply to cross the grain of adjacent plies about at right angles.
The right kind of glue to be used, to insure against separation of the plies and blisters.
Where a bright finish is required, one or both faces, as may be necessary, should be of selected grain to give the desired appearance.

*Member of Rossell & Thayer, Naval Architects and Marine Engineers, Philadelphia, Pa.

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The first requirement calls for careful attention because in the effort to speed up production the timbers are sometimes sliced by a loose cut method which produces a veneer the surface fibres of which are roughed up and injured. This results in a poor surface for finish and an increased tendency to check. Veneers produced in this manner can be readily detected by examination.

The writer has seen the results of an attempt to use a thin layer of a very soft, light weight wood as the center ply of some three ply material and found that the material not only warped badly but the surfaces checked badly.

The crossing of the grain at right angles operates against warping, tends to equalize the strength in both directions, reduces the shrinkage and enables the driving of nails near the edge of the material without danger of splitting. With regard to all of these points properly made plywood is far superior to ordinary wood.

The double diagonal sheathing between the planking and the frames of some types of large wood vessels, and the familiar double diagonal bulkheads, illustrate to some extent the valuable features of plywood.

For use as partitions on shipboard a thickness of 7/8 inch or more is desirable. Where the plywood is to be painted this can be satisfactorily obtained with a three-ply panel, although five-ply panels are preferable; but where expensive hardwoods are to be employed a five-ply construction is necessary, on account of the thinness of these veneers. Otherwise the center layer would be of disproportionate thickness and the strength along its grain would far exceed the strength across the grain of the two outside plies. Small panels can be as thin as 3/8 inch.

As with the materials of class (a) only well tried products should be used on shipboard.

Class (c)—Plymetal

The writer knows of only one product of this kind where the metal is applied to the wood in sheets, although there is another where the metal is sprayed on in fine particles which form a pure metal coating. The first mentioned product has been put on the market after careful tests by one of the successful manufacturers of plywood in sizes suitable for making up as ship's joiner bulkheads or partitions, with steel faces, galvanized or ungalvanized. For entire bulkheads 3/4 inch is a good thickness. Panels can be as thin as 5/16 inch. The faces are thin and offer little resistance to the cutting of the material, driving of screws, etc., and the use of metal eliminates all possibility of checking with consequent disfigurement of the paint coating. The material is of particular value in locations where its fire resistant features are an important consideration and of particular value also in locations where its sanitary and non-absorbent features are an important consideration.

This material is stronger and stiffer than the Class (b) material and very much stiffer than thin steel plates; it can therefore, like the plywood, be used without backing. For successful results it should satisfy the following requirements:

The wood core to be of the proper nature to adjust itself as far as necessary to the steel.

The cement to thoroughly bind the metal to the wood against all influence of moisture or inequalities of expansion due to changes in temperature.

The metal to be thin enough so that any necessary openings can be readily cut through the material.

This material, even when galvanized, requires an efficient paint coating to protect it from corrosion and all edges and other parts that are to be covered up should be thoroughly attended to as well as exposed surfaces.

Comparisons

The principal factors governing the selection of one class of these materials rather than another are the finish desired, the space taken up by the thickness of the completed partitions, the weight and the cost.

Finish

For bright finish work where solid boards are not to be used, plywood is essential. Imitations of some expensive woods can be readily obtained with cheaper grades of plywood and imitations of natural finish wood can be produced on plymetal.

For painted work the smooth, even, sanded surface of the plywood has an advantage although good results can be obtained with ungalvanized plymetal and with composition boards. Any checking of the plywood will mar the finish, whereas with plymetal the possibility of this does not have to be considered. Difficulties are experienced in obtaining a uniform surface in way of the fastenings of the composition boards and the effect is spoiled by any bulging or deformation of this material.

Relative Space

From the standpoint of space plymetal is at the head of the list with plywood a close second and composition boards at a decided disadvantage.

The question of space is of importance in connection with bulkheads between staterooms and in some cases is the determining factor in the selection of the material. In such locations the composition board construction must have a complete wood bulkhead or an even thicker skeleton construction, with a layer of the composition boards on each side of it. The question of space is of small importance overhead or in other locations where a single layer of the composition board would suffice.

Relative Weight

Weight is another important factor because the joinerwork is usually relatively high up and enters adversely into stability questions as well as questions of deadweight and earning power. Here the plywood as the lightest construction is on the whole at the head of the list with plymetal a close second and the composition boards again at a decided disadvantage.

With partition bulkheads the weight handicap of the composition board construction will be at least the entire weight of these boards, and greater where 1 1/8 inch wood backing is used.

Relative Cost

Costs are subject to considerable fluctuation which, while affecting all these products about the same from the labor point of view, do not necessarily affect them the same way from the materials point of view; so comparisons made at one time may not hold good at another. It can be safely figured, however, that for a properly constructed bulkhead the plywood for the same finish as the other products will again head the list as the lowest cost construction, with plymetal next and the composition board construction as the highest in cost. For siding and overhead ceiling the composition board construction without solid wood backing will be the cheapest.

Summary

Putting the foregoing in tabulated form with the most desirable construction under each heading mentioned first, we have:

Finish factor—Plywood, plymetal, composition boards.

Space factor for bulkheading (space elsewhere not being a factor)—Plymetal, plywood, composition boards.

Weight factor for bulkheading and siding—Plywood, plymetal, composition boards.

Weight factor for overhead work—Composition boards, plywood, plymetal.

Cost factor for bulkheading—Plywood, plymetal, composition boards.

Cost factor for siding and overhead work—Composition boards, plywood, plymetal.

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Progress of Motorship Building in Europe

Development of Double Acting Diesel Engines—Large European Auxiliary Sailing Vessels—A 13,000-Ton Motorship

By Our Special London Correspondent

THERE is a strong undercurrent of opinion among British engineers that the ultimate development of the marine oil engine lies in the double acting type. There have been few signs of active progress in this direction during the past six or seven years but it is probable that when developments do occur on a commercial scale they will be extremely rapid.

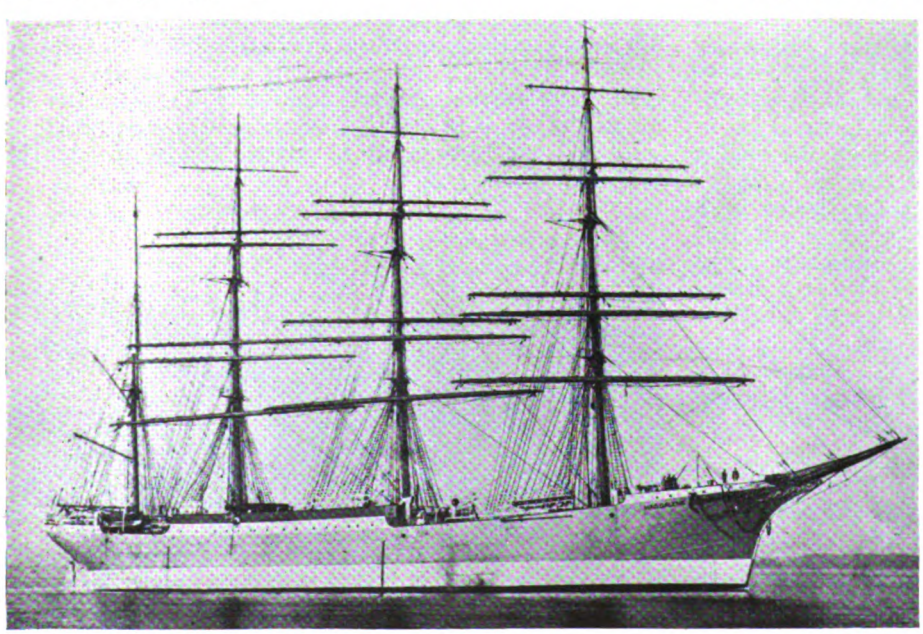
In Hamburg, Blohm and Voss are building some double acting engine motor vessels for the Hamburg American Line and in Great Britain much interest has been evinced in the double acting motor. In two of the largest oil engine building works, namely, Vickers and the North British Diesel Engine Works, experimental motors of this design have been constructed and it is specially significant to note that at the moment both of these firms are actually engaged upon the construction of four cycle single acting sets. In the case of the North British engine, a single cylinder experimental unit was built which developed about 600 brake horsepower and, although no announcement has been made, it is understood that the builders are satisfied with the design and will proceed to its standardized production in the course of a short time. In addition, Harland and Wolff, perhaps the largest builders of Diesel engines in the world, are engaged in an examination of the double acting engine so that within the course of the next year or two a vast change may come over the motorship situation.

The Kobenhavn, of 5,300 Tons, Fitted with a 600 Horsepower Burmeister & Wain Engine

The average European shipowner has not shown any strong disposition in favor of the large oil engined auxiliary and viewed with some suspicion the large program of construction of such vessels which was undertaken in the United States during the war. In certain quarters, however, there is an evident belief in ships of this class and, apart from an auxiliary built before the war, the two largest oil engined sailing vessels ever constructed have just been completed, one in Scotland and the other in Germany. The first boat is of special interest both from the technical and the shipowning standpoint. She has been constructed for the East Asiatic Company, for the dual purpose of trading in the ordinary way and training officers for the East Asiatic Company's large motor fleet.

The *Kobenhavn,* as the new ship is known, is designed to carry 5,300 tons of cargo and is provided with excellent accommodation for a large number of cadets. She is rigged as a five master and it is, rightly, thought that cadets trained in this vessel will gain a wider experience than is normally the case in a mechanically propelled craft, while the installation of Diesel engines will bring her right up to date in the matter of propelling plant. A 600 horsepower Burmeister and Wain engine is fitted and, under power alone, a speed of some 6½ knots will, it is anticipated, be maintained.

The *Kobenhavn* has just sailed on a maiden voyage round the world and has been followed almost immediately



The Magdalene Vinnen, of 5,200 Tons, Fitted with a 550 Brake Horsepower Krupp Diesel Engine

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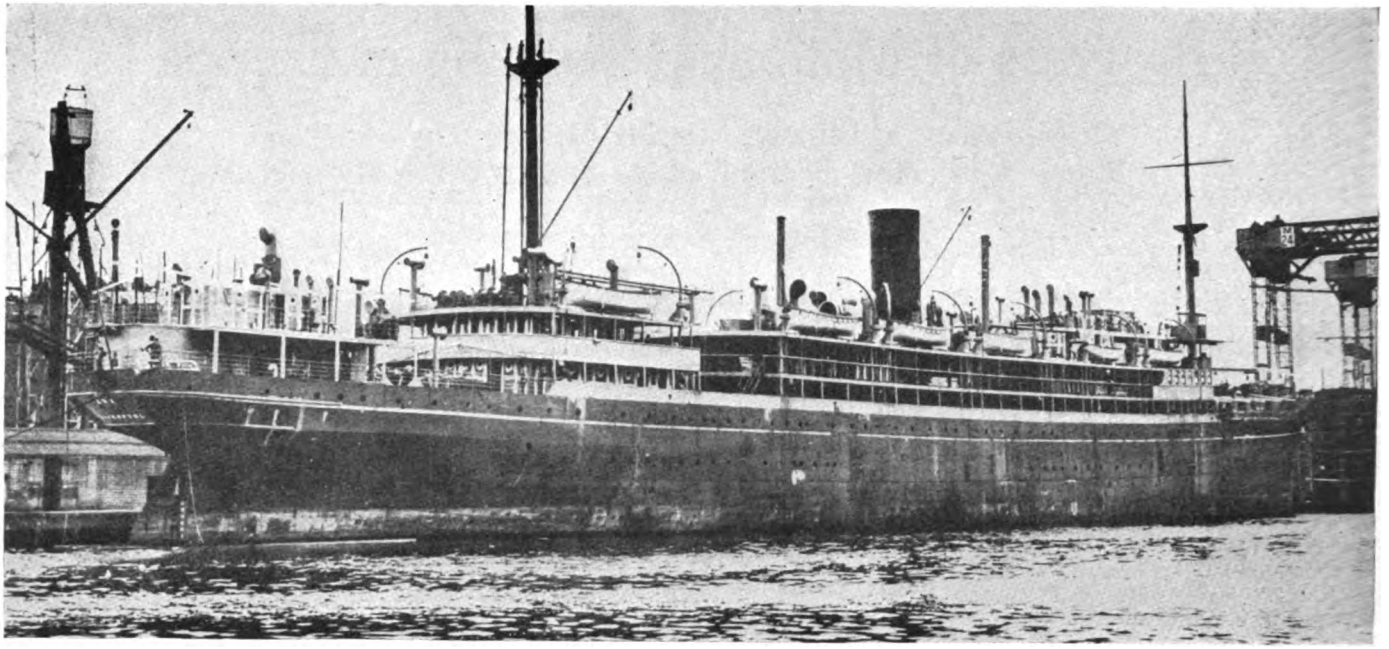

New Motor Passenger Liner Aba, Owned by the Elder Dempster Line

by the new German auxiliary *Magdalene Vinnen* with a deadweight capacity of 5,200 tons. She has been constructed solely as a cargo carrying ship and is equipped with a 550 brake horsepower Krupp engine of the four cycle type. As will be noted from the illustration, she is hardly so attractive a vessel as the *Kobenhavn,* which, incidentally, is provided with such refinements as motor driven winches for hoisting the sails and electric heating throughout the cabins.

FRESH WATER COOLING FOR DIESEL ENGINES

The motorship *Java* has just been delivered to the East Asiatic Company by Burmeister and Wain of Copenhagen and is the third ship of the same size built for this firm within the last year. All these vessels have a deadweight capacity of 13,300 tons and are equipped with machinery of exactly the same type as that installed in the United States Shipping Board motor vessel *William Penn.* Apart from the two Glen liners, the *Glenapp* and *Glenogle,* the *Java* and her sister ships are the largest motor craft yet completed.

The twin screw machinery is of the standard Burmeister and Wain type but it is of interest to engineers who have been concerned with the development of marine Diesel engines from the early days to note that in this vessel, as in the last few Burmeister and Wain productions, the cooling of the cylinders as well as the pistons is effected by means of fresh water. It is a highly debatable point whether fresh water cooling is more desirable than sea water, the contention of the advocates of the former system being that, if the vessel operates in shallow waters, there is always a danger of mud being forced through the pistons and cylinders. Hitherto Burmeister and Wain have only cooled the pistons with fresh water, utilizing sea water for the cylinders. They have now modified their ideas and use fresh water throughout, presumably basing this alteration on the experience obtained with ships equipped with their machinery. This involves the fitting of a large fresh water cooler in the engine room, and circulating sea water through it, thus involving an extra circulating pump.

For those who are interested in the fuel consumption of motor vessels, it is worth recording that a sister ship to the *Java* on her maiden voyage to Australia and back with an average speed of 12 knots had a fuel consumption of 14.1 tons daily and a lubricating oil consumption of 0.53 grammes per indicated horsepower hour including the lubrication of the cylinder as well as hand lubrication and waste in the forced lubricating oil system. The vessel carries an engine room staff of 14 men and has a draft, with full cargo, of 32 feet, the displacement being 19,000 tons.

THE FIRST MOTOR PASSENGER LINER

After many delays, the first motor passenger liner was completed at Harland and Wolff's Belfast yard and sailed on her maiden voyage early in November. This vessel, the *Aba,* owned by the Elder Dempster Line, is for the West African trade and is perhaps not so interesting a craft as the passenger liner *Domala* now approaching completion for the British India Steam Navigation Company. The *Aba* was built during the war as a pure cargo carrying ship and has now only been converted to a passenger liner, the machinery and hull otherwise remaining unaltered. A couple of Harland and Wolff engines are installed, developing about 6,000 indicated horsepower in all, and giving a speed in the neighborhood of 14 knots. Accommodation has been provided for 200 or 300 passengers, both first and second class, and in addition a fair amount of cargo is carried. The engines are not completely up-to-date as they are of the old independent cylinder unit system, which has since been modified in all Burmeister and Wain and Harland and Wolff designs.

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Hull of the Famous Schooner Yacht America, First Winner of the International Cup Which Bears Her Name. The America Is Now Stationed in the Naval Museum at the Naval Academy

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The Motorship Malia

First Vessel Equipped with Camellaird Fullagar Engines

By A. P. Chalkley

IT is probably true to say that no marine oil engine has aroused so much interest among European and American shipowners and engineers as the Camellaird Fullagar type. The original design was developed by the late Mr. H. F. Fullagar, several years ago, and it was taken up and modified by Cammell Laird and Company, the well-known shipbuilders and engineers, while the war was in progress. Designs were prepared and shortly before the armistice, construction had commenced upon a Camellaird Fullagar submarine engine which it was believed would have proved lighter and more efficient than any previously known type. However, the war ended, and it was decided not to proceed with this development but the builders immediately commenced upon the construction of a commercial engine, suitable for installation in cargo ships.

As an indication of the attractiveness of the design, before a single installation was made, licenses for its manufacture were taken out by a large number of prominent shipbuilding firms in Great Britain and abroad, including John Brown and Company of Clydebank, Dunsmuir Jackson and Company and David Rowan and Company on the Clyde, Palmers Shipbuilding and Engineering Company on the Tyne, in addition to Japanese and French builders. Moreover, for stationary work a license was granted to Willans and Robinson who, for many years past, have been building their own type of Diesel motor.

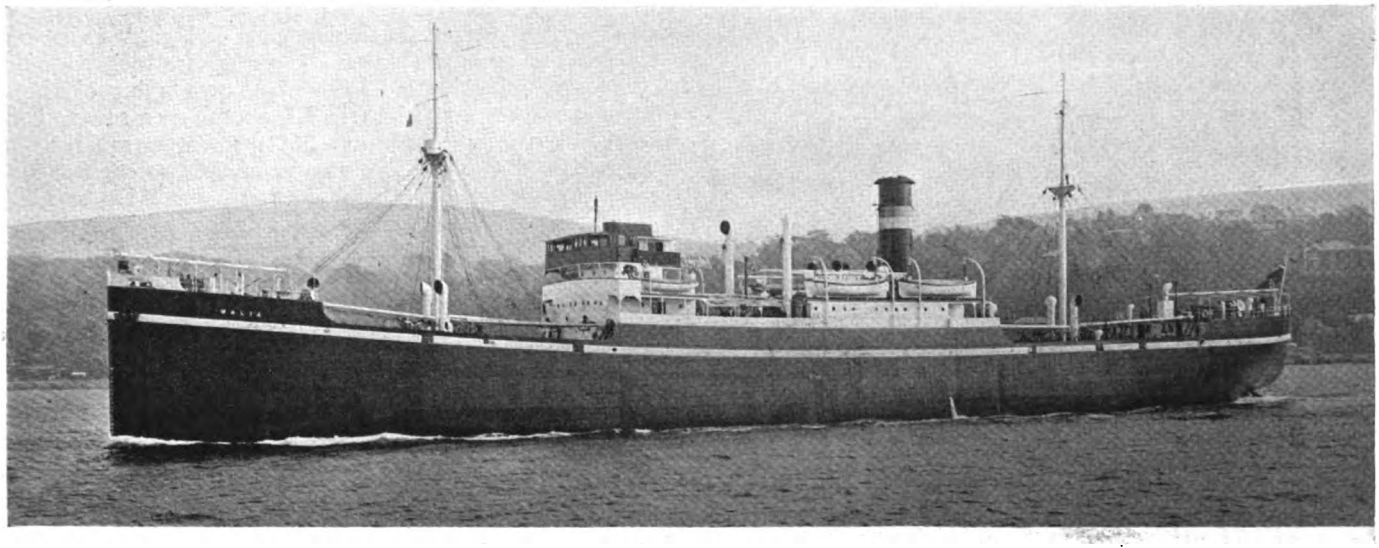
Details of the Malia

The completion of the first ocean-going ship in which Camellaird Fullagar engines are installed was therefore a matter of considerable moment in the development of motorship construction. This vessel, the *Malia,* sailed on her maiden voyage in October, and it need hardly be said that her first trip to the East will be watched with close attention by all British shipowners interested in motorship development; and these comprise practically the whole of the shipowning interests in Great Britain.

The new ship has the following characteristics:

Length between perpendiculars	350 feet
Molded breadth	40 feet 4 inches.
Depth to upper deck	27 feet 3 inches.
Draft when loaded	23 feet.
Deadweight capacity	5,800 tons.
Shaft horsepower	1,100.
Speed, loaded, knots	9.

The *Malia* is a cargo vessel specially designed for the Eastern run and has been built by William Hamilton & Company, Ltd., Port Glasgow, to the order of T. and J. Brocklebank, Ltd., Liverpool, a concern having intimate connections with the Cunard Company which is known to be very definitely interested in the Cammell Laird engine and is credited with the intention of building a transatlantic liner equipped with this class of machinery.



Motorship Malia, Equipped with the First Cammellaird Fullagar Diesel Engines Ever Built

The unusual construction of the engines, which each develop 550 brake horsepower and have four cylinders with a bore of 14 inches, will be readily noted from the illustrations. A unit design is adopted, each unit comprising two cylinders cast together and having separate open ended liners. The lower piston in each cylinder drives direct on to a crank on the main crankshaft and each of the crossheads is coupled by means of two long diagonal rods to the crosshead of the top piston of the adjoining cylinder forming the unit.

The great advantage claimed with this system as compared with other opposed piston designs is that there is only one crank for each cylinder and two crankshaft bearings for each pair of cylinders, since there is no bearing between the cranks corresponding to the two cylinders forming one unit. In the Doxford opposed piston engine, on the other hand, there are three cranks for each cylinder and, with the drive for the scavenging pump, there are 13 cranks in the shaft for a four-cylinder motor.

Valves

The engine is of course of the two-cycle single acting type and the scavenging ports are arranged at the bottom of the cylinder, with the exhaust ports at the top. A single fuel valve is provided for each cylinder, this being located hori-

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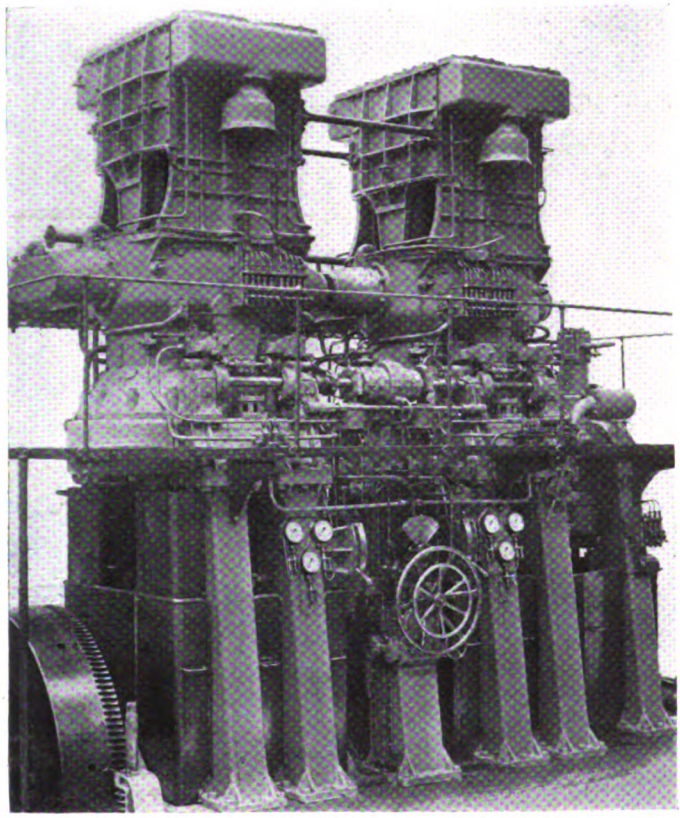
zontally in the center of the liner and actuated in the usual manner from cams on the camshaft through the intermediary of valve levers. The other valves comprise a release valve and a starting valve for each cylinder, the latter being of the non-return type supplied from a mechanically operated starting valve, opened and closed during the starting period from cams on the camshaft.

Scavenging air is provided from a scavenging pump on the front of each cylinder, the top crosshead being rectangular in section and forming the piston of the scavenging pump. The adoption of rectangular pumps is something of a novelty but it is claimed that as a crosshead is needed in any case, the additional height required to form the scavenging pump on the top of the cylinder is practically negligible



One of the 550 Brake Horsepower Cammellaird Fullagar Engines Installed in the Malia

and floor space is thus saved besides which the cost of construction is reduced. The fuel pumps, of which there is one for each cylinder, are driven from two eccentrics on the camshaft and are arranged vertically below this.

MANEUVERING

Maneuvering is effected by means of the large handwheel seen in the center of the engine. By turning it to the right or left, according to the direction of rotation required, air and fuel are put on all four cylinders so that the engine starts up on compressed air. After two or three revolutions the air is cut off two cylinders leaving two firing on oil and two running on compressed air. The remaining two are finally turned over to fuel alone by a continued rotation of the handwheel, the cycle of operation being indicated on the quadrant above the handwheel. The valves are set in the correct position for going astern by turning the handwheel in the opposite direction, causing the camshaft to turn to the requisite angle. To the right of the maneuvering wheel is seen a small hand lever which actuates the suction valves of the fuel pumps and thus increases or decreases the speed of rotation. To the left of the handwheel is a corresponding lever which alters the lift of the fuel valves according to the load on the engine.

Blast injection is employed and a three stage vertical air compressor is driven from a crank on an extension of the crankshaft. All the other auxiliaries, including the fresh water cooling pump and lubricating pumps, are driven by separate electric motors installed in the engine room. There are two lubricating oil pumps operated from 2-horsepower motors and the two fresh water cooling pumps are driven by 7-horsepower motors. The fresh water used for cooling the engine has itself to pass through a cooling tank around which sea water is circulated from a centrifugal pump driven by a 10-horsepower motor. Electric power is supplied from two semi-Diesel engines of the Vickers type driving 45-kilowatt dynamos, and to each of the same engines may be coupled a three stage air compressor, a clutch being provided for this purpose.

TRIALS

On trials the fuel consumption averaged about 0.42 pound per brake horsepower hour using Mexican Diesel oil of a specific gravity of 0.90. This corresponds to a daily fuel consumption of 4½ to 5 tons for a speed of nine knots when carrying 5,000 tons of cargo. It may be added that the mean effective pressure in these engines is high, working out at about 115 pounds (indicated) per square inch with the engine developing its full load. The scavenging air pressure under these conditions is 1.5 pounds per square inch and the blast injection pressure 850 pounds per square inch. The combined indicated horsepower of the two engines running at 125 revolutions per minute was about 1,570 or 1,100 brake horsepower. The average revolutions of both engines was 118, giving an indicated horsepower of 1,480, the speed of the ship being 10.7 knots.

Two engines of the same type, each of 1,000 brake horsepower, have been built and a 5,000 horsepower set of a similar design is under construction.

Bills Introduced in Congress

SENATOR JONES of Washington on November 4 introduced a number of bills relating to marine affairs in the Senate.

S. 2678 would require all ships sailing under a foreign flag and entering the ports of the United States or clearing therefrom to have a permit from the United States Shipping Board.

S. 2679 proposes to distribute the commissioned line and engineering officers in the Coast Guard in grades in the same proportions as provided by law for the distribution in grades of commissioned line officers of the Navy.

S. 2680 proposes to amend Section 4404 of the revised statutes of the United States to provide that the supervising inspectors of the steamboat inspection service be included under the classified Civil Service.

S. 2681 provides for giving a master of a ship of the United States the right to assert a claim against the vessel of which he is master for his wages and disbursements when the owners of the vessel are insolvent and the master would lose his claim if not permitted to assert it against the vessel.

Senator Fletcher on November 4 introduced in the Senate a bill, S. 2683, to amend the act to promote export trade by adding a provision that an association shall be deemed to be engaged in export trade for the purpose of this act if it shall promote agreements among its members as to the price and terms which shall govern the sale of their products to foreign customers engaged in trade promotion abroad, and generally promote such agreements and understandings among its members as are necessary to protect them from hurtful combinations and practices of foreign competitors or customers.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Robertson's Curves

Q. (1140).—Referring to Mr. Alfred J. C. Robertson's paper before the Society of Naval Architects and Marine Engineers, in which he publishes certain curves derived from Admiral Taylor's experiments, you will note that all of the full line curves are for a displacement length coefficient of 160. I have not had the time to study the question as to just how he obtains results for displacement length coefficients other than 160. You will note that he has put in two dot and dash curves, one for 0.62 and the other for 0.78, both for a displacement length coefficient of 80. Please explain Robertson's method of figuring for this and other values between 80 and 160.

A. (1140).—The writer is not in a position to answer the above question absolutely inasmuch as he has not had an opportunity to discuss the matter with Mr. Robertson directly, but the following points are believed worthy of consideration:

In the first place, Mr. Robertson's work is intended primarily, if not entirely, for slow-going merchant vessels. For this class of ship the values of speed length ratio adopted rarely exceed 0.75 and are mostly between 0.5 and 0.65, also the values of displacement length coefficient, excepting for vessels of the greatest size in which draft limitation might force lower values, seldom fall below 150 or 160, also the draft ratio is pretty fairly constant, varying but little from 0.41, which Mr. Robertson has used on his chart. With these points in mind, I am of the opinion that Mr. Robertson did not intend to use other than a straight line method of interpolation for the effect of different values of displacement length coefficient.

Referring to the chart, it will be noted that the value of "C" varies only from 0.735 to 0.75 at a speed length ratio of 65 for a change in value of displacement length coefficient from 80 to 160.

The writer's experience with the use of Taylor's series would indicate that there is little error, even at considerably higher speed length ratios, in using this same straight line method of interpolation, but I rather think that Mr. Robertson included these dash and dot and dash curves more to give an idea as to the order of the effect of varying the displacement length coefficient than for actual use on this chart because, if you will note, he has only plotted them for the limiting values of prismatic coefficient, namely, 0.62 and 0.78.

Use of Special Steels in Ships' Hulls

Q. (1144).—What can you tell me of the use and arrangement of special steels in the hull structure of vessels in which great stresses are anticipated due to extreme proportions, to the disadvantageous location of heavy weights, or to a combination of both?

A. (1144).—High tensile steel has been used for the strength deck, sheer strake, keel and bottom plating of destroyers for some years. These vessels are designed with length to depth ratios as high as 17 and 18. They carry fuel oil amounting in some conditions of loading to as much as 25 percent of the displacement of the ship and distributed well toward its ends. Also in service they are subjected to large dynamic stresses resulting from being driven at high speed into head seas. Hence the necessity for high grade material advantageously disposed from the standpoint of longitudinal strength.

Modern light cruisers built for the British Navy are constructed with high tensile steel plating in the topmost strength decks and outer bottoms. This is for much the same reasons as already noted in the case of destroyers. In cruisers, however, the value of this material for protective purposes is an added argument for its fitting, particularly when, because of the size of the vessels and the correspondingly large stresses involved, the thicknesses required to secure adequate longitudinal strength are such as afford real protection to the ship's vitals except in the case of direct hits by major caliber shells.

High tensile steel was used amidships for a large part of the topside shell plating, for a considerable portion of the shelter and upper deck plating and for the main longitudinal bulkhead plating in the hold of the Cunard express liner *Lusitania*. In this case the classification society allowed a reduction of 10 percent in the scantlings as fixed upon a mild steel basis. It is of interest to note that in the case of the *Lusitania* the ratio of length to depth of strength girder is just over 12.

River steamers and other vessels of light hull structure in which the ratio of length to depth is excessive and in which the installation of heavy, powerful machinery rising through the strength deck permits the use of but very narrow continuous stringer plates may advantageously be fitted with a strength deck stringer and sheer strakes and bottom plating of high tensile steel throughout the ship's mid length.

In the cases referred to above, the maximum stresses estimated in accordance with the accepted methods are generally between seven and ten tons per square inch tensile based upon mild steel. High tensile steel is worked in the ship's longitudinal girder, either to secure greater strength for a given weight of structure or to secure a given strength for a smaller weight of structure than when mild steel is used exclusively.

The physical properties of high tensile and mild steel are as follows:

	High tensile	*Mild steel*
Tensile strength, pounds per square inch	80,000	60,000
Shearing strength, pounds per square inch	(about) 64,000	(about) 48,000
Elastic limit or yield point, pounds per square inch	45,000 to 60,000	35,000 to 40,000
Elongation, percent in 8 inches	20	25
Modulus of elasticy	30,000,000	30,000,000

The fore and aft extent of the high tensile steel worked usually varies from one-half to three-fifths the vessel's length. In cases where careful strength calculations are made and the resulting curve of bending moments shows that the greatest values are confined to a relatively small fore and aft extent, it may be possible to confine the high tensile steel to about three-eighths the vessel's length.

It will be noted that the modulus of elasticity has the same

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value for both high tensile and mild steel. On this account the two materials work together satisfactorily under all ordinary conditions. However, it is considered important in vessels having high calculated stresses to use but one material (either all high tensile or all mild steel) at any given level, as a deck flat or bottom. The reason for this is that, if both high tensile and mild steel are fitted on same level and excessive strains are developed at that level so that the yield point of the mild steel is passed, the entire load will then be thrown into the adjacent high tensile steel. This may be sufficient to produce permanent set in, and perhaps finally rupture, the latter.

It is usually necessary to construct only the portions of the vessel farthest from the neutral axis of high tensile steel, because, the integrity of the structure being maintained, the stresses developed as the neutral axis is approached lessen rapidly. Frequently the bending moments due to hogging and sagging are so related that high tensile steel will be required in either the upper or the lower portion of the vessel only.

Either high tensile or medium steel rivets may be used in the joints between high tensile steel plates. The former are stronger when properly driven but are difficult to work satisfactorily. In calculating the strength of joints between high tensile steel plates, the following unit shearing strength for rivets in single shear may be used:

Medium steel rivets in high tensile steel plates	41,000
High tensile steel rivets in high tensile steel plates	64,000

Punching high tensile steel plates causes serious damage to the material. It is general practice to drill all rivet holes in this material.

See, also, Robinson's "Naval Construction"; "Practical Shipbuilding," by Campbell Holmes; "Structural Design of Warships," by Hovgaard; and "Warships," by Attwood.

Annual Meeting of Institution of Naval Architects

The annual meeting of the Institution of Naval Architects will be held in London on April 5, 1922.

CORRECTION.—In the description of the new ferryboats for Boston harbor, published on page 826 of our November issue, it was erroneously stated that the boilers were built by the Great Lakes Boiler Works, Buffalo, N. Y. These boilers were built by the Lake Erie Boiler Works, Buffalo, N. Y.

PERSONAL MENTION

CHARLES K. MALLORY of Syracuse, N. Y., has been appointed manager of the dry dock division of the surplus property department of the United States Shipping Board.

WILLIAM A. MCCARTHY has been appointed general agent for New York State for the American-Hawaiian Steamship Company's intercoastal service with headquarters at Rochester, N. Y.

E. L. FRIESE, formerly in charge of audits of the Globe Line, has been appointed by Harry Kimball, financial vice president of the United States Shipping Board Emergency Fleet Corporation, to have charge of collections.

W. H. BLASDALE has re-entered the employ of the Eastern Steamship Lines, Inc., as commercial agent, after three years with the coal interests at Pittsburgh. He was formerly the steamship company's general freight agent.

DANIEL H. COX, naval architect and secretary of the Society of Naval Architects and Marine Engineers, has been appointed special assistant to the chairman of the United States Shipping Board to act as liason officer between the Shipping Board and the American delegates to the Conference on the Limitation of Armaments.

H. SCHRECK, who for a number of years was associated with one of the leading shipyards in Germany in the early development of the Diesel engine and later was connected with the oil engine department of the Ingersoll-Rand Company, New York, has opened an office at 17 Battery Place, New York, with Messrs. Whittlesey and Whittlesey as a consulting marine engineer.

MORTIMER E. COOLEY, dean of the college of engineering and architecture of the University of Michigan, has been elected president of the American Engineering Council of the Federated American Engineering Societies. The new head of organized engineering is past president of the American Society of Mechanical Engineers. He graduated from the United States Naval Academy at Annapolis in 1878. After survey work on various assignments, he served in the drafting and design department of the Bureau of Steam Engineering until July, 1881, at which time he was detailed to the University of Michigan as a professor of steam engineering and shipbuilding. After four years at the university he was ordered to the Pacific station for duty, but resigned from the Navy to accept the chair of mechanical engineering. He served during the Spanish war as a chief engineer and for some time following was attached to the League Island Navy Yard. He has carried on a great amount of important appraisal work, including investigations of railways, telegraph lines, river improvements and the like in Michigan, Newfoundland, Wisconsin and many large cities throughout the country.

Dr. M. E. Cooley

GEORGE W. SMITH of Chicago has been made general western representative of the Black Diamond Steamship Company to succeed William S. Miller, resigned. He will handle the business of the company in Chicago in connection with its services from New York, Baltimore, Philadelphia, Boston and Hampton Roads to Rotterdam, Antwerp and Amsterdam. He was formerly foreign freight agent in the west for the Pennsylvania railroad.

OBITUARY

HOLLY MARSHALL BEAN, builder of 76 sailing vessels, died in Camden, Me., on November 9, aged eighty-seven. Mr. Bean was a director of the Coastwise Transportation Company and was for some years president of the Camden Yacht Building & Marine Railway, which he founded.

GARDINER G. DEERING, head of the shipbuilding firm of G. G. Deering Company, Bath, Me., and the oldest active shipbuilder in the country, with more than 100 vessels of various types and rigs to his credit, died on October 24, aged eighty-eight. Mr. Deering originated the idea of substituting stringers and braces for the old-fashioned knee formerly used in the construction of sailing vessels. Mr. Deering was for many years a director in the First National Bank of Bath and a member of the executive board of the Bath Trust Company.

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Shipping and Ship Operation News

Changes in Steamship Routes — Passenger and Freight Activities—Port Plans and Other Notes of General Interest

Shipping to and from Virginia Ports Shows Decided Increase; Pier Expansion Likely for Next Year

Increase in Seagoing Traffic Affects Norfolk and Newport News—Port Commission Recommends Bond Issue of $5,000,000 for New Piers, Warehouses and Grain Elevators

SHIPPING to and from Hampton Roads is on the increase, according to statistics obtained by the Chamber of Commerce-Board of Trade, of Norfolk, Va. In the October report there was a total of 482 vessels or sixty more than were engaged in commerce during September.

There were thirty-two coal cargoes carried from this port in October. The increased number was due to the heavy demand for coal from Cuban and South American ports. The increase in seagoing traffic not only affected Norfolk but was noted in Newport News as well. More ships cleared from Hampton Roads than entered, the difference being 48.

Total tonnage entering and clearing from Hampton Roads during October was 1,410,164, against 1,290,543 in September, an increase of 120,621 tons. There were 165 entrances and 190 clearances from Norfolk last month, and Newport News reported 52 coming in and 75 going out.

American ships led in Norfolk entrances with 53, while only 48 Britishers came to the port. Norwegian vessels during the month totaled 24. The others were as follows: Dutch, 8; Danish, 5; Italian, 8; Japanese, 5; German, 3; Greek, 3; Spanish and Swedish, 2 each; Brazilian, Chilean, Belgian and Portuguese, 1 each. The largest number of ships entering was on the 24th, when 13 boats came in. One ship entered on the 8th and the 30th.

Sixty-four Britishers cleared from Norfolk during the month, against 41 American. Twenty-nine Norwegian crafts put to sea in October. Others were as follows: Dutch and Italian, 12 each; Swedish, 6; French, 5; Japanese, 10; German, 5; Danish, 5; Spanish and Greek, 2 each; Brazilian, Belgian and Chilean. Fifteen clearances on the 24th was the record for the month. Two ships cleared on the 27th, which was the smallest number in October.

Newport News reported a decided increase during the month of the volume of her shipping. Fifty-two ships entered and 75 departed. Nine American ships entered at the Newport News Customs House to 38 British ships. Other nationalities were: Norwegian and Dutch, 3 each; Swedish, Japanese, Italian and Spanish, 1 each.

Of the clearances, 52 were British and 11 American. There were 4 Norwegian and 3 Dutch steamers that cleared during the month. Other nationalities ranked as follows: Swedish, 2; Japanese, Italian, Czecho-Slovakian, and Spanish, 1 each.

Pier Developments

In connection with its recommendations for a bond issue of $5,000,000 for additional pier, warehouse and grain elevator facilities, the Port Commission has just made public a report on the very successful operation of the army base terminal leased by the city 22 months ago from the War Department. This report shows that all of the available space at the army base is now being utilized and that the lease has been profitable to the city and the Department.

Actual operation under the city's lease with the War Department began in December, 1919. Very little freight was handled, however, until February, 1920. The real beginning of business was marked by the movement of 100 tons of flour from the Pacific Coast, which arrived in February and March, and was shipped overseas before the end of June, 1920. Since that time there has been a consistent and substantial increase in business, varying with the seasons, as a large volume of the freight handled consists of cotton and tobacco.

Since December, 22 months ago, 351,373 tons of freight have been received and 307,273 tons forwarded. One hundred and fourteen ships called at the pier in 1920, and 102 have called this year to date.

The October business of the municipal terminal broke all previous records made by the city. Freight received during the month aggregated 21,146 tons, 14,995 tons were forwarded, and there was on hand October 31 a total of 49,016 tons of freight awaiting movement. For three weeks during October the average receipts were 100 cars per day, and for the remainder of the month receipts ranged from 50 to 60 cars per day.

For nearly a year now, the Port Commission has been making a careful study of the traffic possibilities and the needs of the port, and Council has asked the people for a vote on the question next January. These studies, based on the experience at the army base and the experience of other cities, have shown that public terminals can pay for themselves and yield some profit besides.

Notes of Interest to Steamship Operators

The West Coast Lumber Men's Association will hold a conference with the Massachusetts state authorities in Boston, Mass., in the near future, as a result of the meeting with John N. Cole, state commissioner of Public Works for Massachusetts, according to a report from Seattle, Wash. Massachusetts' proposed plan for a mammoth lumber terminal for East Boston connected with Seattle and other northwest lumber ports by fleets of steamships operating through the Panama Canal was disclosed by Commissioner Cole at the recent international port conference of the American Association of Port Authorities.

Representatives of commercial organizations and steamship lines operating from the principal American ports on the Pacific Coast have been informed that the United States Shipping Board would hold hearings at Washington, D. C., on Monday, December 14, with reference to the permanent assignment of the 502 and 535-foot combination cargo and passenger vessels of the trans-Pacific trade. The Board has seven of the 502 type vessels all of which have been delivered and of the sixteen 535 type vessels, ten of them delivered and six are scheduled for delivery between now and April.

Chairman Lasker, of the United States Shipping Board, has announced that as a result of a conference with the Secretary of War, the secretary turned over the remaining piers the War Department has in Hoboken and Brooklyn to the Shipping Board. These piers are No. 1 and 4 in Hoboken, and No. 4 in Brooklyn at the Brooklyn Army Base. This now gives the Shipping Board Piers 1, 2, 3, 4, 5, and 6 in Hoboken, and Piers 3 and 4 in Brooklyn Army Base, total of 34 berths. Chairman Lasker said: "In making pier charges the Government proposes to keep those charges up to sufficient height whereby a private pier owner will get a proper and ample return, but the Government will not aid in keeping up profiteering prices, and prices will average 3½ cents per net registered ton per day."

It is reported that the North German Lloyd plans an independent American service between New York and Bremen. It is planned to place three German steamships on this run. The service may possibly be extended to Baltimore next February.

A new service, to be known as the Blatt Line, has been established at Baltimore, to be operated by Seiler & Company, Vickers Building, Baltimore, Md. Two sailings monthly to Rotterdam, Hamburg and Bremen, will be maintained. The first vessel left Baltimore on November 3.

(Continued on page 946)

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Shipbuilding and Shipyard Development

What the Shipyards Are Doing—Dry Dock Notes—Launchings—New Engineering Projects

Over $10,950,000 in Ship Work, Including Construction of Four Yachts, in Prospect for 1922

Outlook for Vessel Construction, Reconditioning and Equipment, in American Yards Shows Definite Signs of Improvement—Passenger, Freight and Pleasure Craft to Be Built

NEW ship construction and repair work in excess of $8,650,000 is in definite prospect for contract from the present time until well into the first six months of 1922, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE. A portion of this sum includes several extensive ship reconditioning jobs—other than the *Leviathan*—which are expected to come out in the near future; over $2,000,000 is included for the construction of yachts and the balance will be taken up in the building of new freight and passenger ships, the preliminary steps for which are believed to have already been taken.

It is also interesting to note that there are now under construction in the shipyards of this country 581,385 tons of steel ships compared with 143,968 tons for 1914 and that an increase in new enterprises in the shipping industry was indicated during the month of October, 1921, by the formation of four companies with an authorized capital of $50,000 or greater, the total indicated investment being $7,550,000. This compares with $2,150,000 reported for September.

OUTLOOK FOR 1922

MARINE ENGINEERING AND SHIPPING AGE presents the information contained in this article as a substantial indication of better things for 1922. We are able to state definitely that, in addition to at least two new passenger and freight steamers, the construction of four seagoing yachts, varying in length from 165 to 238 feet—the latter craft having an estimated total cost of $2,000,000—is expected to be contracted for during the next few months. In view of the unusual character of the impending contracts and the priority of the data on hand, however, it is not deemed advisable to publish names at this time, although MARINE ENGINEERING AND SHIPPING AGE is enabled to present on absolute authority the facts given below as the "high spots" with regard to proposed new construction.

CONTRACTS PENDING

One steel yacht 238 feet long, oil burning, equipped with steam turbines and electric transmission. The engines are to develop 1,500 horsepower to drive the vessel at a speed of 15 knots.

One steel steam yacht, 225 feet in length, equipped with reciprocating engines and oil burners, to develop 1,200 horsepower and a speed of 14 knots.

A 192-foot yacht equipped with straight Diesel engines developing 750 horsepower to drive the vessel at the rate of 13 knots.

A 165-foot yacht equipped with Diesel engines developing 700 horsepower and driving the vessel at a speed of 13½ knots.

ADDITIONAL NEW WORK

C. V. S. Wyckoff, consulting engineer and naval architect of San Diego, Cal., and New York, reports that he has just been commissioned by the Champlain Company, of New York, to prepare complete plans for the construction of three sea-going cargo tow-boats, each of 1,500 tons capacity; twelve consort barges, each of 3,000 tons capacity, and one high speed supply and passenger boat of 200 tons capacity. The cost of construction of these vessels is estimated at $2,300,000, and it is expected that bids will be asked in about three months.

All the power driven craft will be designed on the combined "Arconstruc-Hullfin" principle which was first introduced in the ferryboat *Poughkeepsie*, now being built at the Mill Basin shipyard of the Atlantic Gulf & Pacific Company. They will have multiple units of Diesel-electric power, electric motors for driving the propellers, and pilot-house control. The entire fleet will have electric equipment throughout, each craft having dual generating sets.

NEW FERRIES

It is learned that the Department of Plant and Structures of the City of New York will soon have under way preliminary plans and specifications for the building of at least two new steel ferries, of the double ended type, for the East River. They will be about 170 feet in length and cost about $200,000 each. Bids will probably be asked for the latter part of January.

President Harding Will Request Congress to Grant Subsidies for American Merchant Marine

Would Secure One-Half of Immigrant Traffic for American Lines, Enforcement of Coastwise Laws Relating to Philippines, Abolition of Transport Service on Pacific and a Decision on Preferential Rail Rates

PROOF that definite action is to be taken to obtain our share of shipping in the near future is received as we go to press. The fact that a special commission has been functioning for the last ten days with the object of determining the amount of subsidy that is necessary for the various trade routes shows that the President favors and will advocate this form of Government aid for shipping. The commission will prepare a definite concrete plan which the President announces will be sent to Congress with a special message within six weeks.

The members of the commission are as follows: Professor Emory R. Johnson, University of Pennsylvania; Winthrop L. Marvin, vice-president and general manager of the American Steamship Owners' Association; Rear-Admiral H. H. Rosseau, U. S. N.; Rear-Admiral Clarence S. Williams, U. S. N.; Daniel H. Cox, of Cox and Stevens; Grosvenor M. Jones, author of a monograph on "Government Aid to Merchant Shipping," and Norman Beecher of the Admiralty staff of the Shipping Board's counsel.

FEATURES OF PLAN

It is understood that among those measures to be recommended are:

1. The requirement that 50 percent of all aliens, admitted under the 3 percent restricted immigration laws, be forced to book passage on American-flag ships.

2. That the coastwise laws be extended to the Philippines on February 1, 1922.

3. That the Army and Navy transport services on the Pacific be discontinued and this traffic be turned over to private interests.

4. That hearings be held to determine the advisability of putting in effect Section 28, which restricts the railroads in granting export rates to shipments of commodities to be shipped on American vessels.

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Specifications for Reconditioning The Leviathan Set New High Mark in American Engineering Accomplishment

William F. Gibbs and Construction Department Staff of International Mercantile Marine Company Complete Gigantic Task—Ship to Be Ready for Sea in 1923

BIDS for reconditioning the steamship *Leviathan,* which is looked upon as the biggest repair job in American history, are scheduled for opening about December 29, the general conditions and requirements to be completed by March 15, 1923, providing the contract is awarded not later than January 15, 1922. If the contract is awarded later than January 15, 1922, fourteen months will be allowed to complete the work.

The task of preparing the detailed specifications, which are in twelve volumes in addition to two volumes of photographs and a large number of blue prints, has been successfully accomplished by the construction department of the International Mercantile Marine Company under the control of William Francis Gibbs. The completion of the plans and specifications is looked upon as a masterful stroke of marine engineering. Considerable credit is being given Mr. Gibbs, who has carried out the work in the face of much adverse criticism, and his efforts are regarded as another sample of the results obtainable when someone says "It can't be done."

Fire Test on Leviathan.

BEGUN IN 1919.

Preparation of detailed specifications for reconditioning the *Leviathan* was begun by Mr. Gibbs and his department in December 1919. In April, 1920, the specifications were in shape to submit to shipbuilders for bids. The Shipping Board, however, was undecided about letting the contract, and work was temporarily stopped. In April, 1921, it was decided to complete the outline plans for the vessel and to revise the former specifications. This work was finally finished early in November and specifications issued in pamphlet form for bids. The two volumes of plates included with the specifications give all necessary designs for interior decorations, furniture, clocks, lamps, electric light fixtures, fans and other accessories for staterooms, saloons, smoking rooms, restaurants and the like. About forty detail drawings of the ship, necessary to give prospective bidders a comprehensive outline of the work involved, are also included. Drawings are made to 1/16 scale and include an inboard profile of the vessel as she will appear when reconditioned; complete deck plans, giving the location of all spaces, furniture, layout for cabins, saloons, restaurants, etc.; details of all bulkhead changes to be made, these last having been approved by the American Bureau of Shipping; equipment details for such apparatus as fresh and salt water heating systems; arrangement of fresh water tanks; oil fuel system arrangement, oil fuel line expansion joint details; heating coils for fuel oil tanks; oil fuel filling and overflow systems, approved by the American Bureau of Shipping; fuel oil transfer system; ballast system in the boiler rooms, and forward and aft spaces; bilge piping diagrams; return heating coils; smothering lines in oil tanks; layout of boiler room floors; burners for the fuel oil system; arrangement of pipes in the pipe tunnel; ventilating details; drains, condensers, pumps, etc.

For the convenience of prospective bidders, the specifications are divided into twelve volumes, covering various subjects as follows:

TITLE SUBJECTS.

Title No. 1 deals with the general conditions and requirements; Title No. 2, oil fuel installation; Title No. 3, joiner work, interior finish and decoration, furniture, furnishings, miscellaneous equipment, etc.; Title No. 4, galleys and pantries; Title No. 5, air ports, side lights, doors, ports and hatches; Title No. 6, electrical installations, this volume probably being one of the most technical of its kind ever published; Title No. 7, plumbing, sanitary and fire extinguisher systems; Title No. 8, deck, floor and plumbing drains; Title No. 9, steam heating; Title No. 10, ventilation; Title No. 11, top sides; Title No. 12, lifeboats, their handling and stowage gear, this title provides for the equipment of the ship with lifeboat capacity for 4,750 persons.

In addition to general drawings prepared for bids, a staff of about sixty draftsmen is busy preparing detail drawings for actual construction which will be available for the use of the company to which the contract is awarded. The scope of the work of getting out the specifications may be understood from the fact that about seventy-five draftsmen were occupied on them the greater part of the time since last spring when the matter came up for settlement.

SAN BENITO'S RECORD

Cyclone Fails to Stop Electrically Propelled Fruit Ship

The United Fruit Company's new cargo carrier *San Benito,* the largest electrically propelled freighter built and equipped abroad, arrived in New York October 24, on her maiden voyage from Almeria, Spain, after a hard tussle with cyclonic seas. For 24 consecutive hours she was tossed about in the worst storm that Captain J. C. Jackson of the vessel has experienced in his 29 years at sea, but she reached port in perfect condition so far as her equipment was concerned.

Among the 28 passengers on the *San Benito* were W. McClelland, director of electrical engineering of the British Admiralty, and his deputy, S. D. Constable. Both were elated on the success of the trip. "Never saw anything more reliable in my life than this electric drive," said Mr. McClelland.

The *San Benito* is a new ship and this was her maiden voyage. She was built by Workman, Clark & Company of Belfast, for the United Fruit Line. She has a tonnage of 5,500, is 336 feet long, has a beam of 45 feet and was designed for a speed of 12.5 knots. Her electrical equipment, built and installed by the British Thomson Houston Company, Ltd., consists of a 2,040 kilowatt Curtis turbine generator, driving a 3,000 horsepower synchronous motor attached to the propeller. The motor is set in the stern, thus eliminating the shaft tunnel and shafting and adding considerable to the cargo space. Her circulating pumps, forced air draft and ventilating system are also electrically operated.

On her trip she maintained an average speed of 10.5 knots, considered remarkably well for the weather encountered, and made a maximum speed of 15.1 knots. She left the shipyards at Belfast on September 20 and cleared Almeria with a cargo of onions, figs and grapes on October 10. She will be sent to Boston where she will be placed in service to the West Indies.

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133 Steel Vessels Building and Contracted For in the United States; 126 Are For Private Ownership

Seagoing steel tonnage under construction and contracted for, according to yards, as indicated in the latest bulletin issued by the American Bureau of Shipping, is as follows:

Steel Tonnage Building and Contracted for in the United States, November 1, 1921

Shipyard	Private Account No.	Private Account Gross	Emergency Fleet No.	Emergency Fleet Gross	Total No.	Total Gross
Bethlehem S. B. Corp., Ltd.						
Baltimore D. D. Plant	2	11,600	..	.....	2	11,600
Harlan Plant.....	1	1,462	..	.....	1	1,462
Sparrow's Point.....	3	40,500	3	31,500	6	72,000
Union Plant.....	5	48,000	..	.....	5	48,000
Daniels, Oscar, Co.....	1	7,800	..	.....	1	7,800
Federal S. B. Co.....	3	18,000	..	.....	3	18,000
Fuller, Geo. A., Co.....	1	6,121	..	.....	1	6,121
Hanlon D. D. & S. B. Co.	1	1,500	..	.....	1	1,500
Los Angeles S. B. Co.....	..	.....	1	7,300	1	7,300
Merchant S. B. Corp.....	3	21,850	..	.....	3	21,850
Moore S. B. Corp.....	2	10,250	..	.....	2	10,250
N. Y. Harbor D. D. Co...	2	6,570	..	.....	2	6,570
New York S. B. Corp.....	4	27,400	3	31,500	7	58,900
Southwestern S. B. Co....	2	10,388	..	.....	2	10,388
Standard S. B. Corp.....	1	5,600	..	.....	1	5,600
Sun S. B. Corp.....	4	35,066	..	.....	4	35,066
Texas S. S. Co.....	1	6,700	..	.....	1	6,700
Union Const. Co.....	4	23,800	..	.....	4	23,800
Union S. B. Co.....	6	40,800	..	.....	6	40,800
Virginia S. B. Corp.....	1	6,060	..	.....	1	6,060
Total	47	329,467	7	70,300	54	399,767
China	..	.....	1	7,000	1	7,000

River and Harbor Steel Tonnage Building and Contracted for in the United States for Private Owners, November 1, 1921

Shipyard	No.	Gross	Shipyard	No.	Gross
American Bridge Co.....	22	7,953	Marietta Mfg. Co.....	6	2,550
American Car & Foundry Co.	3	1,500	Merchant S. B. Corp.....	1	250
Bethlehem S. B. Co. (Balt. D. D. Plant).....	1	488	Midland Barge Co.....	2	170
Consolidated S. B. Corp.....	3	2,575	Nashville Bridge Co.....	1	258
Doullut & Williams.....	3	1,350	New Jersey D. D. & S. B. Co..	4	2,694
*Dravo Contracting Co.....	8	950	Rice Bros.....	4	1,600
Eichleay, John, & Co.....	4	540	Spedden S. B. Co.....	1	325
Federal S. B. Co.....	3	3,600	Standard S. B. Corp.....	1	250
Johnson Iron Works.....	2	700	Staten Island S. B. Co.....	2	2,260
Kyle & Purdy.....	4	3,590	Ward, Chas., Eng.....	3	1,350
Lawley, Geo.....	1	350	Total.....	79	35,303

*Dravo Contracting Co. also have contract with U. S. S. B. for three steel barges.

SALE OF SHIPS

20 Vessels to Be Offered If Diesel Drive Is Installed

Admiral W. S. Benson, Commissioner of the United States Shipping Board, in Charge of Construction and Machinery Efficiency, has issued the following announcement:

"The United States Shipping Board has long recognized the prime necessity of developing Diesel engine driven tonnage if this country is to take its rightful place as a maritime nation.

"The Board has determined today to offer for sale 20 of its vessels to purchasers who will agree under bond, or other satisfactory guarantee, to the installation of full Diesel propelling machinery in such vessels. At present days' costs, this installation in a 10,000-ton vessel will amount to around one-half million dollars. Sales of Diesel tonnage have been made abroad as low as $60.00 but the going rate today is probably nearer $80.00. The Board is prepared to sell for cash the above tonnage to the highest bidder who guarantees immediate installation of types of machinery to be approved by the Board on such a basis as to make this offer an attractive one.

"It is the unanimous opinion of the Board that in this action it is carrying out three important provisions of the Merchant Marine Act. First, placing of its tonnage in private hands; second, providing the most modern type of vessel for service under the American flag, and, third, giving work to American shipyards at a time when their business is at very low ebb."

FIVE ELECTRIC BOATS

New York Engineer Preparing Plans for New Craft

Plans and specifications for five new packets to ply between New York and Buffalo will be under way next week by R. R. Livingston, Marine Engineer, of 2 Rector Street, New York City, according to official information obtained by MARINE ENGINEERING AND SHIPPING AGE. The boats will be equipped with Diesel electric drive, and it is believed the total cost will be close to half a million dollars.

Preliminary figures place the length of the packets at about 160 feet with a carrying capacity of 500 tons each. There will be two Diesel engines, driving generators, and two motors, driving twin propellers. The power plant of each boat will develop about 260 horsepower.

It is understood that the five boats are to be completed by May, 1922.

Trial Trip of the Dixie Arrow

The *Dixie Arrow*, built for the Standard Transportation Company at the plant of the New York Shipbuilding Corporation, Camden, N. J., left the yard on its trial trip November 23, 1921.

The overall dimensions of the ship are 485 feet in length, beam 62 feet 6 inches, and depth 39 feet 6 inches. She is equipped with three single end Scotch main boilers and one 3,200 indicated horsepower engine of the four cylinder, quadruple expansion, four crank, direct acting, surface condensing type. This engine is capable of propelling the vessel loaded to the specified draft at a speed of 11 knots. The vessel will have ten double main cargo tanks with a combined capacity of 3,500,000 United States gallons. It has a displacement of 18,277 tons and carries a crew of 62 men.

Libraries Planned for Every American Ship

With the slogan "A Library for Every American Ship," the American Merchant Marine Library Association has taken over for American merchantmen in peace-time the work carried on by the American Library Association during the war in supplying good reading matter to the men at sea. The association is perfecting plans for placing a library of from eighty to one hundred books on every American merchant ship for the use of the sailors and officers.

The headquarters of the association are at 82 Beaver Street, New York, with Miss M. M. Barkley, formerly of the Social Service Bureau, in charge, and Arthur H. Battey, a New York newspaper man, formerly news editor of MARINE ENGINEERING AND SHIPPING AGE, serving as agent of the organization.

Shipping Board Transactions Involving Millions Result in Action Against C. W. Morse

Following an investigation into the transactions of Charles W. Morse with the United States Shipping Board, Fletcher Dobyns, special assistant to the Attorney-General, will present the evidence before the Federal Grand Jury, it was announced from Washington. According to testimony of witnesses before the Walsh Committee, millions of dollars in excess of what had been contracted for were paid over to the Morse interests, including $3,000,000 advanced to the Groton Iron Works, after the plant had been in receivers' hands, in order to lift this court action. It is claimed that materials which had been purchased for the construction of ships had been used by the Morse companies for other construction. It is also alleged that loans under mortgage carrying false representation were negotiated.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Recondition Motorship, San Francisco, Cal.—Two new tail shafts are being made for the motorship Lassen, which is in dry dock at the yard of Barnes & Tibbitts.

To Purchase Tugs, Coos Bay, Oregon.—It is reported that the steady increase of business may necessitate the purchase of a seagoing tug and a smaller tug for business inside the harbor. The port commission is negotiating for a big tug in New York and for a smaller one with local firms.

Will Purchase Trawler, Port Hawkesbury, N. S.—It is learned that the Leonards Fisheries, Ltd., will purchase at once another trawler to replace the trawler Baleine, which has become a total wreck and has been abandoned by her owners and underwriters.

To Convert Subchaser Into Yacht, Philadelphia, Pa.—Henry A. Hitner's Sons have sold the subchaser No. 71 to C. A. Cromwell, after having purchased the vessel from the Government at a price of $1,250. The vessel will be renamed the Nomad, and will be converted into a yacht.

Pump Contract Award, Brooklyn, N. Y.—James Shewan & Son has been awarded a contract for installing a new circulating pump on the electric drive ship Archer and preparing the vessel for sea. The ship is operated by the Barber Line and it is expected she will leave shortly for the Far East.

Large Repair Contract, Seattle Wash.—The Todd Dry Docks, Inc., has been awarded the contract for repairing the freighter Arizonan, which struck a ledge off San Juan Island, October 4. The company's bid amounted to $42,900, the work to be completed within twenty-five days. A number of plates of the vessel will have to be replaced.

Ship Repairs, San Francisco, Cal.—The steam schooner Thomas Rolph is at the yard of Barnes & Tibbitts having boilers and machinery installed. This vessel was recently bought by George E. Billings. The steam schooner Oregon, of Wilson Brothers & Company, is also on the ways of the plant receiving a new tailshaft.

Large Repair Job Bids In, San Francisco, Cal.—According to a report from San Francisco the United Engineering Company, with a price of $189,300, was low bidder on the contract for reconditioning the Matson Navigation Company's steamer Lurline. The bid is still under consideration, but is said to be far below any others.

New Lightship Contemplated, Aberdeen, Wash.—Great satisfaction is expressed by marine men over an appropriation of $400,000 for a modern lightship for Grays Harbor, and it is the general opinion that the bill stands a good chance of being passed, as such a vessel has been a basic need of the port for many years and would mean a great stimulation of cargo trade.

Tugboat, San Francisco, Cal.—The Enterprise Engine Company was awarded the contract for the installation of engines in the new inspection and tugboat to be constructed for the State Harbor Board, and which is being designed by D. W. and R. Z. Dickie, engineers and naval architects, San Francisco. The vessel will be 57 feet in length, 14 feet beam and 6 feet depth, and will cost $25,000.

Repair Contracts Awarded, Oakland, Cal.—The Moore Shipyards have been awarded the contract for installing a new low pressure cylinder on the steamer Oriental, which sustained damages on her maiden voyage from Shanghai to San Francisco. The bid was $8,850. The company was also awarded the contract for plate repairs on the Pacific Mail liner Golden State on a bid of $2,378. On the east coast the Baltimore Shipbuilding Company, Baltimore, Md., was awarded a contract by the Shipping Board to repair the steamer West Arrow at a cost of $2,481.

Engine Contract Award, New York.—The Hooven, Owen Rentschler Company, New York City, has been awarded a contract for two 2,000 horsepower engines which are to be installed in the steamship San Jacinto, which is now undergoing a general overhauling at the yard of the Tietjen & Lang Company, Hoboken, N. J. The engines will be 23-30-66 by 42-inch stroke, and it is understood the contract involves about one hundred thousand dollars.

Fireboat, New York.—Trials of the new fireboat John Purroy Mitchel, built for the city of New York by the Standard Shipbuilding Corporation, have been successfully completed on the Hudson River. The boat ran a true mean speed of 14.29 knots and a practice run with the tide of 15.72 knots. The contract speed was 12 statute miles an hour. The boat will be inspected by the Fire Department before it is taken over by the city in the near future.

Repairing Steamer, Brooklyn, N. Y.—The contract for dry docking and miscellaneous repairs to the steamship Livingston Roe, of the Standard Oil Company of New Jersey, has been awarded to the Robins Dry Dock & Repair Company, of the Todd Shipyards Corporation, at a price of approximately $6,700. Other competitors for the work were the W. & A. Fletcher Company, $7,520; the Morse Dry Dock & Repair Company, $7,740, and the Staten Island Shipbuilding Company, $8,600.

Contract Awards, Hoboken, N. J.—The Tietjen & Lang Dry Dock Company has been awarded a contract for repairs to the steamship Finland of the International Mercantile Marine Company. The steamship H. M. Flagler, of the Standard Oil Company of New Jersey, and the steamship Hampden, of the United American Lines, have been awarded to the W. & A. Fletcher Company, Hoboken, N. J., for various repairs.

Admiral Steamers Reconditioning, San Francisco, Cal.—The passenger steamer Queen will be repaired and overhauled, the work requiring about three months. The steamer Admiral Rodman, recently damaged by fire, will also be repaired. These steamers being laid up necessitated the revision of the schedules of the entire coastwise fleet of the Admiral Line, and the rearrangement has been carried out, according to H. S. Eaton, assistant manager at San Francisco.

Shipbuilding Activities at Seattle, Wash.—Indicative of activity in shipping circles, the Harbor Island plant of the Todd Dry Dock, Inc., at Seattle, Wash., has increased its force from 500 to 800 men. In addition to its usual business the Todd Company is fulfilling three repair contracts for trans-Pacific vessels, aggregating $100,000. Todd builders are now converting the Puget Sound Navigation Company's steamship Whatcom into a ferryboat at a cost of approximately $100,000.

Ferryboat Contract Award, Alameda, Cal.—The James Robertson Shipyard has been awarded a contract for the construction of the first ferryboat of the Golden Gate Ferry Company. The work on the boat will be rushed and it is expected the vessel will be ready for operation by next May. Construction of the slips and wharves for the boat will be started on January 1. According to plans of the company a second ferryboat will be constructed later.

Improving Steerage Accommodations, Hoboken, N. J.—Improvement of steerage passenger accommodations and engine repairs are included in the work to be done on the steamships George Washington and American Legion, the contracts for which have been awarded to the Tietjen & Lang Dry Dock Company by the Shipping Board.

Yacht to Be Reconditioned, City Island, New York.—The Robert Jacob Shipyard has been awarded a contract for general overhauling and installation of new engines in the yacht Sabalo by the Tams, Lemoine & Crane Company, 52 Pine street, New York. Two Winton Diesel engines, direct drive, of 300 horsepower each will be installed. It was estimated that the contract will cost close to $50,000.

Awards to Fletcher Company, Hoboken, N. J.—The W. & A. Fletcher Company has been awarded the contract for reconditioning the United Fruit steamship Heredia, now lying at New Orleans, La. The work to be done on this ship is extensive and includes the laying of new wooden decks, repairing considerable hull damage as a result of collision, dry docking, renewal of canvas boat deck, renewing portions of insulations, renewing tank top insulation, reconditioning of refrigeration system and machinery and local repairs.

Equipment Orders Placed, New York.—The Augusta, Gardiner & Boothbay Steamboat Company, 283 Water street, Augusta, Maine, has placed an order with the Kearfott Engineering Company, Inc., 95 Liberty street, for new machinery for their river boat Virginia. It is understood that an order for export has been placed with the same company for engine and boiler room equipment for a tugboat. The boat is quite similar to the 100-foot harbor tugs built in this country for the Shipping Board.

Steamship to Be Reconditioned, New York.—Specifications are expected to be ready for distribution about December 15 for reconditioning the steamship Manchuria, of the International Mercantile Marine Company, 9 Broadway, New York. It is believed the contract will involve the expenditure of about a quarter of a million dollars and it will probably be awarded about Christmas time. It is understood the work consists chiefly of converting the third class quarters to 75 per cent closed accommodations and the balance into open accommodations and general voyage repairs.

Fireboats, Philadelphia, Pa.—Another fireboat will be added to Philadelphia's harbor fire fighting fleet in 1922, according to official information obtained by Marine Engineering and Shipping Age. The city now has under construction two oil burning fireboats, one of which will be delivered the latter part of this month and the second will be delivered the early part of January. Messrs. Cornell & Matthews, marine engineers, have supervised construction of these boats.

We are advised by Director James T. Cortelyou, of the Department of Public Safety, Philadelphia, that the city "will probably purchase a third oil burning fireboat some time during the coming year."

Ferryboats, New York.—It was announced that bids for the construction of three electric drive ferryboats for the Department of Plants and Structures of the city of New York, previously reported, will be advertised for by December 1, with bid openings about December 20.

The municipal ferryboat Mayor Gaynor, of New York, is expected to be taken from service about December 1, dry docked and preparations made for the installation, about December 17, of a new Babcock & Wilcox boiler. Bids will probably be asked for two new propellers for the steamer, at a cost of about $2,500. The total cost of the work on the boat will be close to $50,000.

Steamship Reconditioning, New York.—One of the largest repair jobs for the closing of 1921 is anticipated for the near future when plans and specifications will be completed by Tams, Lemoine & Crane, naval architects, 52 Pine street, New York, for the extensive reconditioning of the steamship Relay, of the All America Cable Company. A survey of the ship is now being made preparatory to the drawing up of the plans and specifications. Although details are not yet available as to the full extent of the work, it is stated that two new Scotch boilers will be installed. Definite announcement of the opening date of bids will probably be made by the naval architects within the next two weeks.

Steamer to Be Converted, New York.—It is reported that specifications are in course of preparation for the extensive reconditioning of the Munson Line steamship Walter D. Munson, and that bids may be asked for within the next two or three weeks, the total cost of the job being estimated at a quarter of a million dollars. The work, if carried out as contemplated, is said to include the conversion of the ship into a passenger and freight steamer.

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CONSTRUCTION FOR NAVY

Vessels under construction for United States Navy and their degree of completion as reported October 31, 1921, by the Bureau of Construction and Repair, Washington, D. C., are as follows:

Type Number and Name	Contractor	Percent of Completion Nov. 1, 1921 Total
BATTLESHIPS (BB)		
45 Colorado	New York S. B. Corpn.	83.0
47 Washington	New York S. B. Corpn.	69.8
48 West Virginia	Newport News S. B. & D. D. Co.	64.0
49 South Dakota	New York Navy Yard	35.2
50 Indiana	New York Navy Yard	33.2
51 Montana	Mare Island Navy Yard	27.6
52 North Carolina	Norfolk Navy Yard	36.7
53 Iowa	Newport News S. B. & D. D. Co.	29.9
54 Massachusetts	Beth. S. B. Corpn. (Fore River)	10.4
BATTLE CRUISERS (CC)		
1 Lexington	Beth. S. B. Corpn. (Fore River)	26.7
2 Constellation	Newport News S. B. & D. D. Co.	15.5
3 Saratoga	New York S. B. Corpn.	29.4
4 Ranger	Newport News S. B. & D. D. Co.	2.9
5 Constitution	Philadelphia Navy Yard	11.7
6 United States	Philadelphia Navy Yard	11.1
SCOUT CRUISERS (LIGHT CRUISERS) (CL)		
4 Omaha	Todd D. D. & Const. Corpn.	96.8
5 Milwaukee	Todd D. D. & Const. Corpn.	93.7
6 Cincinnati	Todd D. D. & Const. Corpn.	87.4
7 Raleigh	Beth. S. B. Corpn. (Fore River)	63.7
8 Detroit	Beth. S. B. Corpn. (Fore River)	71.6
9 Richmond	Wm. Cramp & Sons Co.	78.
10 Concord	Wm. Cramp & Sons Co.	71.
11 Trenton	Wm. Cramp & Sons Co.	52.
12 Marblehead	Wm. Cramp & Sons Co.	47.
13 Memphis	Wm. Cramp & Sons Co.	40.
AUXILIARIES		
Repair Ship No. 1, Medusa (AR1)	Puget Sound Navy Yard	70.6
Dest. Tender No. 8, Dobbin (AD3)	Philadelphia Navy Yard	66.4
Dest. Tender No. 4, Whitney (AD4)	Boston Navy Yard	86.8
Sub. Tender No. 3, Holland (AS3)	Puget Sound Navy Yard	21.5
Aircraft Tender, Wright (AZ1)	Tietjen & Lang	96.
PATROL VESSELS		
Gunboat No. 22, Tulsa (PG22)	Charleston Navy Yard	71.1
Authorized but not under construction or contract: (1) Transport No. 2.		
DESTROYERS		
338 Wasmuth	Mare Island Navy Yard	99.7
339 Trever	Mare Island Navy Yard	97.7
(a) 340 Perry	Mare Island Navy Yard	79.5
(b) 341 Decatur	Mare Island Navy Yard	73.7
Destroyers authorized but not under construction or contract: (12) Nos. 348 to 359 inclusive.		

(a) Destroyer 340, Perry, launched October 29, 1921.
(b) Destroyer 341, Decatur, launched October 29, 1921.

SUBMARINES		
115 S-10	Portsmouth, N. H., Navy Yard	94.6
116 S-11	Portsmouth, N. H., Navy Yard	92.1
117 S-12	Portsmouth, N. H., Navy Yard	91.
118 S-13 (c)	Portsmouth, N. H., Navy Yard	89.6
123 S-18	Electric Boat Co. (Quincy)	97.
124 S-19	Electric Boat Co. (Quincy)	96.5
125 S-20	Electric Boat Co. (Quincy)	98.5
126 S-21	Electric Boat Co. (Quincy)	94.9
127 S-22	Electric Boat Co. (Quincy)	95.8
128 S-23	Electric Boat Co. (Quincy)	94.
129 S-24	Electric Boat Co. (Quincy)	93.
130 S-25	Electric Boat Co. (Quincy)	93.5
131 S-26	Electric Boat Co. (Quincy)	92.4
132 S-27	Electric Boat Co. (Quincy)	91.
133 S-28	Electric Boat Co. (Quincy)	91.6
134 S-29	Electric Boat Co. (Quincy)	90.5
136 S-31	Electric Boat Co. (San Fran.)	97.6
137 S-32	Electric Boat Co. (San Fran.)	96.
138 S-33	Electric Boat Co. (San Fran.)	99.2
139 S-34	Electric Boat Co. (San Fran.)	95.4
140 S-35	Electric Boat Co. (San Fran.)	92.8
141 S-36	Electric Boat Co. (San Fran.)	90.3
142 S-37	Electric Boat Co. (San Fran.)	88.1
143 S-38	Electric Boat Co. (San Fran.)	82.4
144 S-39	Electric Boat Co. (San Fran.)	79.8
145 S-40	Electric Boat Co. (San Fran.)	78.6
146 S-41	Electric Boat Co. (San Fran.)	79.7
153 S-42	Electric Boat Co. (Quincy)	76.3
154 S-43	Electric Boat Co. (Quincy)	76.9
155 S-44	Electric Boat Co. (Quincy)	74.9
156 S-45	Electric Boat Co. (Quincy)	75.4
157 S-46	Electric Boat Co. (Quincy)	74.
158 S-47	Electric Boat Co. (Quincy)	73.2
159 S-48	Lake T. B. Co. (Bridgeport)	98.
160 S-49	Lake T. B. Co. (Bridgeport)	96.
161 S-50	Lake T. B. Co. (Bridgeport)	92.1
162 S-51	Lake T. B. Co. (Bridgeport)	89.8
FLEET SUBMARINES		
60 T-2 (SF 2)	Electric Boat Co. (Quincy)	99.3
163 V-1 (SF 4)	Portsmouth, N. H., Navy Yard	6.3
164 V-2 (SF 5)	Portsmouth, N. H., Navy Yard	4.9
165 V-3 (SF 6)	Portsmouth, N. H., Navy Yard	4.8

Note: Submarines authorized but not under construction or contract:
Fleet Submarines (6) Nos. 166 to 171.
Neff Submarine (1) No. 108.

(c) Submarine 118, S-13, launched October 20, 1921.

Tietjen & Lang Contracts, Hoboken, N. J.—The Tietjen & Lang Dry Dock Company has been awarded the contract for repairing damage as a result of a fire in the hold of the Southern Pacific steamship El Alba, at an estimated cost of $6,400. The same yard has also been awarded the Cylde Line steamship Huron for the repair of damage as a result of going ashore in the south, costing about $6,000; and the New England Navigation Company steamer Mohegan and a New York Central car float which were in collision recently in the East River. The steamer sustained damage to her stem, the contract in this case involving about $3,500 and for the car float about $2,500.

New Steamer, Charleston, W. Va.—The Charles Ward Engineering Works has been awarded a contract for the construction of a stern wheel shallow draft steamer for use in southern waters by the Mexican Petroleum Company. The vessel will be 136 feet over all in length, 34 feet beam and 5½ feet deep. She will be equipped with high pressure steam engines with 18-inch cylinders and 7-foot stroke, developing about 700 horsepower. The boilers will be equipped with four oil burners. The boat was designed by Cox & Stevens, naval architects, 15 William street, New York.

Centennial State Awarded, Hoboken, N. J.—The W. & A. Fletcher Company was awarded the contract for reconditioning the Shipping Board steamer Centennial State. The work consists chiefly of reconditioning the third class quarters, making new staircases and enlarging old staircases, general voyage repairs and overhauling of piping, radiators and electrical work. The bids were as follows: W. & A. Fletcher Company, $17,085; Standard Shipbuilding Corporation, $19,247; Tietjen & Lang Dry Dock Company, $19,412; Morse Dry Dock & Repair Company, $20,500.

New Freight and Passenger Vessels, Baltimore, Md.—Supplementing the announcement carried exclusively on August 27, 1921, Marine Engineering and Shipping Age is advised that the Merchants & Miners Transportation Company is taking preliminary steps toward getting out plans and specifications for a combination freight and passenger steamship. Although no details are available at present, it is believed the proposed ship will be built of steel, approximately 350 feet in length, and will cost close to $1,000,000. It is understood that definite decision as to whether the ship will be coal or oil burning is still pending. Mr. A. D. Stebbins is president and general manager of the transportation company.

Steamer Repairs, Hoboken, N. J.—The contract for reconditioning the Clyde Line steamship Lenape has been awarded to the Tietjen & Lang Dry Dock Company on a bid of $124,000 and twenty-eight days. The bids submitted were as follows:

Tietjen & Lang Dry Dock Co.	$124,000	28 days
Morse Dry Dock & Repair Co.	113,500	45 days
Robins Dry Dock & Repair Co.	128,600	36 days
W. & A. Fletcher Company	169,000	72 days
Alderton Dry Dock Co.	151,000	55 days
Federal Shipbuilding Co.	226,900	90 days

The Tietjen & Lang yard was also awarded a contract for repairs to the Cylde Line steamship Apache, which was damaged in collision at sea recently with the schooner Singleton Palmer. The repairs will cost about $9,000.

Ferryboats, Chester, Pa.—The Sun Shipbuilding Company has been awarded a contract for the construction of two ferryboats for the Pennsylvania Railroad Company for use between Camden, N. J., and Philadelphia, Pa. Both vessels and equipment were designed by the Pennsylvania Railroad Company, and will be completed in about six months, the total cost being estimated at close to half a million dollars.

The boats will be 168 feet in length over guards 55 feet beam, and 14 feet 8 inches deep. They will have six transverse watertight bulkheads, a 111-foot 6-inch cabin, and will be equipped with three-cylinder compound engines 18 by 26 by 26 by 22 inches stroke, driving two four-blade propeller wheels 8 feet 2 inches diameter with 12 feet 6 inches pitch. Two Babcock & Wilcox watertube boilers having 3,300 square feet of heating surface and 22 square feet of grate surface will be installed. The boats will use coal for fuel and the engines will develop about 800 horsepower. It is expected the steamers will be completed by the summer of 1922.

Hull Repairs, Brooklyn, N. Y.—The Clinton Dry Docks Company was awarded the contract for general hull repairs for the steamer Patrol, a service boat of the Department of Plant and Structures of the City of New York. The work includes the renewal of 84 plates, 31 frames, renewal of keelson 12 lineal feet, 200 square feet of hull plate renewal for patches, etc., renewal of five additional frames, 10 feet additional on keelson, 50 keel rivets, 100 rudder rivets and tap bolts, 500 hull rivets and 250 feet of calking. The total bids submitted were as follows: Clinton Dry Docks, $13,509; Robins Dry Dock & Repair Co., $15,870; Standard Shipbuilding Corp., $17,065.50; Jas. Shewan & Sons, $20,383; Lord Dry Dock Company, $23,358; National Dry Dock & Repair Co., $24,114; New York Harbor Dry Dock Co., $25,789; Theo. Crane & Son, $28,156; Ira Bushey & Son, $31,436; J. W. Sullivan, $37,153; Federal Shipbuilding Co., $37,442.50.

Big Repair Job, Chester, Pa.—The Merchant Shipbuilding Corporation has been awarded a contract for reconditioning the United American Line steamships Franklin and Fairmont, bids for the former being opened at noon on October 26. The principal item covered in the specifications was the installation of a new deck on the Franklin, with special provisions to be considered for doing similar work on the Fairmont. It is believed that the total amount involved for the two ships will be close to $100,000. The bids covering the Franklin were as follows:

Name of Yard	Wood Deck	No. of Days	Steel Deck	No. of Days
Merchant Ship'ing Corp.	$55,500	..	$58,000	52
Federal Ship'ing Co.	59,000	36	75,000	42
Standard Ship'ing Corp.	63,000	..	66,000	60
New York Harbor Dry Dock Co.	63,081	..	67,729	49
Bethlehem Ship'ing Corp.	64,600	48	60,657	30
Staten Island Ship'ing Co.	66,500	..	74,200	..
Newport News Ship'ing Co.	72,200	35	80,700	40
W. & A. Fletcher Co.	74,065	60	86,635	65
James Shewan & Son	79,000	..	86,500	38
Morse Dry Dock & Repair Co.	80,000	40	89,000	50
Tietjen & Lang Dry Dock Co.	89,770	..	91,690	45
Robins Dry Dock & Repair Co.	92,800	..	99,800	45
Sun Shipbuilding Co.	169,500	..	107,900	45
Theo. Cranes' Sons	145,982	..	154,892	56

It was announced that steel decks will be installed.

Steamer Repairs, Hoboken, N. J.—The Clyde Line steamships Algiers and Algonquin have been awarded to the W. & A. Fletcher Company for dry docking and various repairs. The same yard was also awarded the tanker J. A. Bostwick, of the Standard Oil Company of New Jersey, for general repairs, on a bid of $4,300, and the steamship Maumi, of the Foreign Transport & Mercantile Company, of New York, for dry docking and miscellaneous repairs, at a price of about $3,500.

The company has also been awarded a contract for repairs to the steamship Joseph Seep, of the Standard Oil Company of New Jersey, at a price of $6,200. The work consists of dry docking, drawing tail shaft, hull repairs and cargo system and machinery overhauling. The same company was also awarded the steamship Acropolis, of the Stephen Stephanidis Company, 24 State street, New York, for dry docking and repair of hull damage at a cost of about $3,000.

SHIPYARDS AND DRY DOCKS

May Buy Western Shipbuilding Plant, San Pedro, Cal.—It is reported that J. J. Tynan, manager of the Union plant of the Bethlehem Shipbuilding Corporation at San Francisco, Cal., is in the east conferring with Charles M. Schwab and others regarding the probable purchase of the plant of the Southwestern Shipbuilding Company.

Company Formed to Build Dry Dock, North Vancouver, B. C.—The Burrard Dry Dock Company, Ltd., was recently incorporated with a capital of $1,000,000 by Clarence Wallace, John J. Coughlan and Robert C. Lennie, to build a floating dry dock at Vancouver Harbor. Slips, work shops, machinery, piers, etc., will be included in the project, and when completed the company will carry on a general shipbuilding and repair business.

Purchase Plant, San Francisco, Cal.—It is announced by George A. Armes, president of the General Engineering Company, that his concern has purchased the holdings of the Triangle Engineering Company, all of the equipment of which will be installed at the plant of the General Engineering Company, which will be considerably enlarged to accomodate the additional equipment. The firm formerly operated under the name of Mooney & Young, but with the appointment of Mr. Armes as president and a partner, decision was made to change the name to General Engineering Company.

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PORT IMPROVEMENTS

Terminals, New Bern, N. C.—The Board of Aldermen contemplates the construction of a municipal terminal at Union Point with dock facilities and railroad track connections.

Wharf Extension, Halifax, N. S.—The Commercial Cable Company plans an extension to its wharf at Halifax. A description of the site and plans have been sent to the Department of Public Works at Ottawa.

Recreation Pier, Brooklyn, N. Y.—The Department of Docks & Ferries, Pier A, North River, New York, plans a recreation pier at Coney Island, requiring 1,700,000 cubic yards of sand fill, 5,120,000 b. m. feet of timber, 110,000 tons of rock and 4,000 reinforced concrete piles.

Equipment for Freight Shed, Tacoma, Wash.—The Port Commission will construct a new freight transit shed on the water front, to be equipped with the latest freight handling, conveying, hoisting equipment, etc. The estimated cost of the project is $500,000.

Dredging, New Jersey.—The contract for dredging the section for the proposed inland waterways connecting Barnegat Bay with the Manasquan River, has been awarded to L. B. Harrison, Market Island, Paterson, N. J., by the Board of Commerce and Navigation, Trenton. The bid was $.245 per cubic yard.

Removal of Wreck, Philadelphia, Pa.—Contract for the removal of the wreck of the steamship Katahdin, sunk in Philadelphia harbor, has been awarded the Merritt & Chapman Wrecking Company of Philadelphia, Pa., on its bid of $24,066. According to specifications the derelict must be removed within eight months.

Docks, Etc., Miami, Fla.—The City Commissioners contemplate building an addition to the permanent pier and also a temporary dock for loading lumber on numerous small vessels. The city plans to sell $300,000 bonds, and that, with the $100,000 already on hand, will make $400,000 available for this construction work. Charles W. Murray is city engineer.

Channel, Miami, Fla.—The Bakers Haulover District, of which J. C. Baile is chairman, contemplates the construction and maintenance of a cut 200 feet wide and 1,200 feet long, between the Atlantic Ocean and Biscayne Bay, according to plans by the War Department, and to cost approximately $300,000. Hobart Crabtree is temporary engineer.

Dredging, Manitowoc, Wis.—The City, Z. Zaneler, clerk, is having plans prepared for dredging the Manitowoc River and making harbor and channel improvements to cost about $30,000. F. Alter, City Hall, is engineer. It is reported that the Reiss Coal Company and the Manitowoc Shipbuilding Company will appropriate toward the cost of this project.

Cold Storage Plant and Docks, Los Angeles, Cal.—President Weaver, of the Los Angeles Chamber of Commerce, and officers of the California Fruit Growers' Exchange, have laid plans for a cold storage plant and shipping docks before the harbor commission, San Pedro, Cal., and have been assured of the board's full co-operation. More than $500,000 will be spent for the construction of docks and providing equipment for the handling of the fruit.

Docks and Terminal, Philadelphia, Pa.—The Philadelphia and Reading Railroad, Reading Terminal, is having preliminary plans prepared by M. Baker, architect, Reading Terminal, Philadelphia, for a two-story terminal and docks of reinforced concrete and steel to have concrete pile and wood pile foundation, at Knights avenue, Camden, N. J., for railroad and ferries. The estimated cost of the project is $2,000,000.

Piers Destroyed by Fire, Weehawken, N. J.—At a recent fire the piers of the Erie Railroad Company at the foot of Baldwin avenue were burned. Piers A, B, C and D, a three-story warehouse, four lighters and forty-eight freight cars filled with merchandise were destroyed before the flames were under control. About twenty barges, belonging to the Erie Railroad, which were lying between the piers were damaged. The loss is estimated at from $1,500,000 to $2,000,000.

Extensive Harbor Improvements, San Francisco, Cal.—According to Miss Hilda Gohrman, secretary of the Board of State Harbor Commissioners, plans for extensive harbor developments representing an expenditure of more than $2,500,000 are being pushed to completion in order to afford relief locally and give employment to hundreds of men. Plans and specifications for the $2,500,000 warehouse to be erected at Barry and Second streets are nearing completion and bids are expected to be called for within a few weeks.

Large Port Project, Grays Harbor, Wash.—According to latest reports a large port terminal will be erected at Grays Harbor, according to present specifications now under consideration by the port commission. The dredging of one 28-foot channel below Hoquiam is included in the work to be carried out. The Grays Harbor Construction Company has the contract for constructing the first wharf unit and transit shed at an estimated cost of $141,760. The wharf will be 800 feet in length and 300 feet wide and will have a warehouse erected upon it.

GOVERNMENT WORK

Radio Tower, Eureka, Cal.—Specification 4533. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a 300-foot radio tower.

Radio Tower, Keyport, Wash.—Specification 4538. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a 200-foot radio tower.

Repairs to Radio Quarters, North Truro, Mass.—Specification 4532. The Bureau of Yards and Docks, Navy Department, Washington, D. C., will have repairs made to the radio quarters.

Repairs to Barracks, Norfolk, Va.—Specification 4535. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans repairs to the Marine Barracks, No. 2.

Radio Quarters, Amagansett, N. Y.—Specification 4536. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans radio quarters.

Deferrization Plant, Annapolis, Md.—Specification 4539. The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans a deferrization plant.

Refrigerating Equipment, San Diego, Cal.—Specification 4543. The Bureau of Yards and Docks, Navy Department, Washington, D. C., will install cold storage and refrigerator equipment at the Naval Hospital.

Lubricants.—Schedule 115. The Marine Corps, Quartermaster's Department, Washington, D. C., is in the market for 15,000 pounds of cup grease and 7,000 pounds of transmission gear lubricant to be delivered to Post Quartermaster, Quantico, Va., Paris Island, S. C., and Hampton Roads, Va. Further information may be obtained upon application.

NEW INCORPORATIONS

The Port Jefferson Shipyard Corporation, Port Jefferson, L. I., has been incorporated with a capital of $1,000,000 to operate a shipbuilding and repair plant. The Delaware Registration Trust Company, 900 Market street, Wilmington, Del., are representatives of the company.

The International Ferry, Ltd., Sarnia, Ont., has been incorporated under the Dominion Companies Act with an authorized capital of $200,000 to operate a ferry service, for automobiles, passengers and conveyances of all kinds, between Sarnia, Ont., and Port Huron, Mich., and to carry on a general navigation and steamship business. The incorporators include G. C. Stevenson, Port Huron, Mich., and N. L. LeSueur.

The Mackenzie Basin Fisheries, Ltd., Calgary, Alta., has been incorporated under the Dominion Companies Act with a capital of $200,000, to carry on a general fishing and fur business and to operate ships for transportation of freight and passengers. The incorporators include C. J. Ford, L. H. Miller, G. A. Costigan, Miss M. Acton, and G. Kirkpatrick, Calgary, Alta.

The Twin Submersible Salvage Company, Portland, Maine, has been incorporated with a capital of $10,000,000 to engage in the business of salvaging, recovering, reclaiming, restoring, etc., disabled, sunken or submerged boats, ships, etc., build bridges, piers, dams, etc., dredging, operate towboats, vessels and do all things incident.

Hind, Rolph & Company, Inc., San Francisco, Cal., has been incorporated with a capital of $250,000 to build and operate vessels of all kinds.

The Tri-National Steamship Corporation, Dover, Del., has been incorporated with a capital of $4,000,000 to own and operate boats.

The International Salvage Corporation, Wilmington, Del., has been incorporated with a capital of $200,000 to engage in the business of salvaging and raising sunken vessels.

FOREIGN ACTIVITIES

Port Improvements at West Africa.—Official Government reports received at Washington, D. C., state that an extensive program of construction and improvement of railways and port works is planned for Angola, a Portuguese West African possession, including the building of port works at Benguela Velha, Santo Antonio do Zaire, Porte Alexandre, Saco, Geraul, Bero and Mossamedes, enlargement of the present harbors at Loanda and Lobito, a new railway for Benguela Velha to the Amboim coffee district and the extension of the Mossamedes Railway.

Trial Trip of Axpe Mendi, Stockton-on-Tees, Eng.—The steamship Axpe Mendi, built by the Ropner Shipbuilding & Repairing Company, Ltd., Stockton-on-Tees, recently made her official trial trip, which was reported as very satisfactory. The steamer was built to the account of the Compania Naviera Sota & Aznar, of Bilbao, Spain, and to Lloyd's classification, 100 A-1, and to the British Board of Trade. She is a vessel of about 6,035 tons.

Motorship Lobos, Greenock, Scotland.—The motorship Lobos, a twin screw vessel built by Harland & Wolff, Ltd., in their Greenock shipyard for the Pacific Steam Navigation Company, had a very successful trial trip. The vessel, which is classed 100 A-1 at Lloyd's, is 419 feet long, 54 feet broad, 35 feet 3 inches deep, with a gross tonnage of 6,479, and is the first cargo vessel built in Greenock propelled by Diesel engines. The vessel is designed to maintain a mean speed of 11½ knots.

To Improve Harbor, Leghorn, Italy.—The Italian Government has approved plans for the extension of the harbor of Leghorn, whereby its capacity will be doubled and a canal 12 miles long will be constructed, thus connecting Pisa with the sea.

Naples Harbor Improvement, Italy.—The present congestion at Naples again brings to the fore the proposed port improvements which were under consideration just before the war, and the Government as well as two Italian steamship companies now plan to make such improvements, according to recent reports from Italy. Three large piers are contemplated from the present Molo San Gennaro to be equipped as a freight and passenger terminal, giving easy access to the hotel section of the city, the piers to have complete railway connections, mostly underground. The piers and warehouses will cost approximately 65,000,000 lire. Another project contemplated includes the widening of the present Nolo Orientale by 50 meters and the construction of six warehouses of 28,800 square meters floor space, this undertaking to cost 40,000,000 lire.

Waterways, Antwerp, Belgium.—The Antwerp port authorities will soon resume the improvement and extension of the Dutch-Belgium waterways, which were commenced prior to the war. The river Meuse is to be deepened, and a new canal is to be constructed between Antwerp and Moerdyk. A lateral canal will also be constructed on Dutch territory to Maasbracht, giving Maestricht access to foreign shipping, and linking the latter city by a lockless canal with Liege and the Kempen mines, while only two locks would separate it from the Rhine, one from Brussels and five from Antwerp.

Fleet Addition, Spain.—According to a recent announcement the Ybarra Line will soon add to its fleet three new vessels of 5,000 tons each, namely, the Cabo Rocha, Cabo Tinoso and Cabo de las Heurtas. The company maintains a cargo service between the United States and Spanish ports.

May Have Motor Fleet, Gothenberg, Sweden.—The Transatlantic Steamship Company, of Gothenberg, has been granted a license by the Swedish Government to sell two of its steamers, each of about 8,000 or 9,000 tons deadweight. This company has recently built only motorships, and it is thought very probable that it will dispose ultimately of all its steamers and rely solely on motor vessels.

Liner to be Launched, Bremen, Germany.—The Norddeutscher Lloyd recently launched their new 9,000 ton liner Koeln from the Vulcan yard at Bremen. The vessel has a speed of 13 knots and has accommodations for 340 second class and 1,000 third class passengers.

Order Placed for Vessel, Stettin, Germany. An order has been placed by the Norddeutscher Lloyd for the construction of a sister ship to the Minden, a cargo vessel for the same company, recently launched and having accommodations for a limited number of passengers, the vessel to be built in the Stettin yards. This new vessel will be fitted with turbine engines, however, and a third vessel is to have a Diesel motor arrangement. All three vessels will be combination passenger and cargo carriers.

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STEAMSHIP INTERESTS—*(Continued)*

A fleet of eight passenger and freight ships which will be known as the Mexican Navigation Company will soon be placed in operation under the Mexican merchant marine, and nearly half of this tonnage will operate to San Francisco and other Pacific Coast ports. Agencies will be established at all principal ports. Vessels will call at Los Angeles and San Francisco on the Pacific Coast, and later on the company will extend the service to Seattle. Galveston, New Orleans and other Gulf ports will be included in the Atlantic service to New York. A regular service will be maintained to all ports of call, and the principal ports of South and Central America will be included in the service. Part of the company's program calls for the purchase of two combination passenger and freight steamers of 10,000 tons, these two vessels to be the largest of the fleet, and to be placed on the Pacific Coast run. Luis Martinez, one of the foremost shipping men in Mexico is said to be heading this organization. More than $4,000,000 has been raised throughout Mexico to aid in the Government's merchant marine, and it is reported that the development of this new line will be aided by the Mexican Government on a subsidy basis.

It is reported that Horace T. Bennett, Manatee, Fla., and W. E. Mann., Palmetto, Fla., with others are interested in establishing a company to operate a boat line at Bradentown, Pa.

In a contract recently awarded by the United States Post Office Department, the Admiral Line, Seattle, Wash., has put into effect a system analogous to the railway postal service in handling mail to and from the ports of Southwestern Alaska. United States Post Office clerks with duties corresponding to those of the men in charge of mail cars on the railroads will be placed aboard all passenger ships carrying Alaskan mails. The new contract, counterpart of one awarded simultaneously to the Alaska Steamship Company, authorizes a minimum compensation of $2,000 a round trip to southwestern Alaska, with a corresponding minimum for the service afforded the nearer ports of southeast Alaska.

BUSINESS NOTES

Mr. H. W. Parsons of the marine engineering department of the General Electric Company, 120 Broadway, New York, and for ten years in the service of that company has resigned to take up new duties with John R. Proctor, Inc., Bayonne, N. J., contracting engineers, in charge of their New York office at 120 Liberty Street. Mr. Parsons has an exceptionally wide acquaintance in the marine field and his many friends wish him success in his new enterprise.

The Marine Equipment & Supply Company, 116 Walnut Street, Philadelphia, Pa., announces that George S. Ruhland has resigned as president of the company, and William Kirkland, former secretary and treasurer, has been elected as president and treasurer. Percy L. Smith, who for many years has been engaged in the motorboat and shipbuilding industry, will be associated with the company in the capacity of secretary.

The firm of Mooney & Young has been changed to the General Engineering Company, with offices at 1013 Battery Street, San Francisco, Cal. George A. Armes, formerly president of the Moore Shipbuilding Company, is president; John F. Mooney is vice-president, and James H. Young is treasurer and secretary. The company conducts a machine and ship repair works.

The Exeter Machine Works, Inc., of West Pittston, Pa., announce the appointment of The Hendrie and Bolthoff Manufacturing and Supply Company, of Denver, Colo., as exclusive sales agents for the Exeter Rotary Pump line in the Denver district. The Hendrie and Bolthoff Manufacturing and Supply Company specialize in the marketing of tools, pumps and supplies for railways, machine shops and mills.

TRADE PUBLICATIONS

Tube Facts.—The manufacture of condenser tubes at the works of the Scovill Manufacturing Company, Waterbury, Conn., is taken up in detail in a booklet recently issued by this company. Season cracking and corrosion are the two principle causes of the failure of condenser tubes. In the Scovill laboratories investigations are being carried on continually to determine and eliminate causes of weakness in the structure of the metal. Modern manufacturing processes to a great extent eliminate many of the defects. Production of seamless tubing by both the drawing and cupping processes are outlined, as well as the production of Scovill Admiralty tubes. Special alloys, as bronze, nickel silver, naval brass, and the like, are made into Scovill tubing, as well as the condenser work.

Don't Let It Happen to You.—This book gives the story of a business venture that might have been profitable only inadequate equipment caused a loss on certain contracts rather than gains that had been expected. The Williams Tool Corporation, Erie, Pa., uses this story to introduce the proper principles, machinery and dies which should be used for pipe threading, and the necessity of always maintaining an adequate supply of spare dies and machine parts. The book is a complete treatise on pipe threading practice and will be supplied by the company free on request.

Drill Chucks.—Three circulars describing ball bearing, geared, and two jaw drill chucks have been sent out by the E. Horton & Son Company, Windsor Locks, Conn. Price lists are given, as well as the specifications.

MARINE SOCIETIES

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National President—John H. Pruett, 423 Forty-ninth St., Brooklyn, N. Y.
National Treasurer—A. B. Devlin, 187 Randolph Ave., Jersey City, N. J.
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ATLANTIC COAST SHIPBUILDERS' ASSOCIATION
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

AMERICAN STEAMSHIP OWNERS' ASSOCIATION
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

UNITED STATES SHIP OPERATORS' ASSOCIATION
149 Broadway, New York
President—C. H. Potter

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5 Adelphi Terrace, London, W. C.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND
39 Elmbank Crescent, Glasgow.

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Bolbec Hall, Westgate Road, Newcastle-on-Tyne

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